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# THE PRACTICAL TEACHER

MR. T. CLANCY,
*The Coming President of the National Union of Teachers.*

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## MARCH NUMBER.


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# THE PRACTICAL TEACHER

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## THE ESSENTIAL CONDITIONS OF HEALTHY LIFE IN SCHOOLS.


BY ARTHUR NEWSHOLME, M.D., F.R.C.P. (LOND.),

*Examiner in State Medicine to the University of London, and in Preventive Medicine to the University of Oxford; Medical Officer of Health of Brighton.*


(*A Lecture delivered at the College of Preceptors, Jan. 7, 1899.*)

MY subject embraces the whole of the physical side of school education, so far as it may affect the health of scholars and teachers, whether in day or in boarding schools. It is intended, furthermore, to be treated, not from an exclusively ideal standpoint—though it is well to aim at the best conditions for school life—but rather in relation to the ordinary practical conditions under which the great majority of secondary schools, and in particular private schools, are carried on.

It is not improbable that at no distant date the governing bodies or proprietors of secondary schools will be called upon to submit to inspection by educational authorities, local or central. It is well, therefore, that they should have a fairly clear conception of what are likely to be the requirements the fulfilment of which will place such schools on the list of efficient schools. In ascertaining what is absolutely indispensable to place their school premises in an efficient hygienic condition, school proprietors cannot do better than consult Schedule VII. of the Education Department's Code of Regulations for Elementary Day Schools, which specifies the structural requirements in the planning and fitting up of public elementary schools. It is highly probable that these requirements would form the model for similar requirements for secondary schools in connection with a Secondary Education Act. As will be gathered from my subsequent remarks, however, some of these regulations are ignorant and defective, and I trust will not be followed by you.

The requirements of the Elementary Education Code make a distinction in stringency between new schools and schools already in existence, which is reasonable. Assuming that it is proposed to erect a new school, the first

**Site.** point is to select a suitable site, embracing as much circumferential open space as can be secured. The close vicinity of higher buildings or of trees preventing free access of air and light is to be deprecated. The Education Department lays down the minimum size of site, in the absence of exceptional circumstances, as a quarter of an acre for every 250 children, an open space of at least 30 square feet per

**Playgrounds.** child being preserved. Playgrounds should be properly levelled, drained, enclosed, and fitted with simple gymnastic appliances. A portion should be covered, having one side against a wall. A covered way should never connect the offices with the main building.

**Construction of School.** The whole of the site of the school should be covered by a layer of concrete not less than six inches thick, and the space between wooden floors and the concrete foundation ventilated by air-bricks inserted in opposite walls. The walls must be damp-proof. According to the Education Department's requirements, the walls of every room used for teaching, if ceiled at the level of the wall-plate, must be at least 12 feet high from the floor to the ceiling; and if the area contain more than 360 superficial square feet, 13 feet; and if more than 600, then 14 feet. Great care must be taken to render the walls impervious to cold and heat. Roofs open to the apex are not approved, and can only be permitted where the roofs are specially impervious to heat and cold, and where apex ventilation is provided.

Internal walls should preferably


***Next Month:***

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be of smooth cement, which can be painted, and is then perfectly washable. This is the ideal, but washable distempers are fairly good. The floor should consist of narrow, carefully-dovetailed boards, or well-seasoned wood blocks laid on cement.

**Cleanliness.** It is essential that every part of a schoolroom should be washable. Dry dusting and sweeping are to be deprecated, unless in the latter instance the floor has been liberally strewn with wet tea-leaves or wet sawdust to prevent scattering of dust. We now know that *dust* is one of the main enemies of health. The dust of a schoolroom contains not only the mixed organic and mineral refuse trodden in from the street, but also the particles shed from the skin and mucous surfaces of scholars and teachers. It not infrequently contains lung expectoration and nasal mucus, which has become dried, and is then easily scattered about the atmosphere, as dust, by movements of scholars, etc. This dust may be merely irritating, setting up bronchial catarrhs. It may, however, have been derived from pupils who are consumptive, or who have diphtheria in a mild and unrecognized form, or from a scarlatinal patient; and it is easy to understand how, under such conditions, disease may be spread by means of school-dust. Hence the importance of avoiding dust in school-life; hence the necessity for preferring *washing* to *dusting*, *scrubbing* to *sweeping*.

The subject of ventilation will be considered at a later point. In the meantime we may emphasise the fact that the "close smell" which so frequently assails one on entering a schoolroom during actual work is *due to dirt*. This dirt is—

(*a*) Gaseous and volatile, derived chiefly from the lungs.
(*b*) Dirt of the skin, through deficient washing and bathing.
(*c*) Dirty personal apparel.
(*d*) Dust in the schoolroom.

If the walls and floors of the schoolroom are kept free from dust, and if cleanliness of skin and of apparel of the scholars be secured, a large share of the difficulty in connection with ventilation will have been removed. Often what is ascribed to deficient ventilation is really due to uncleanliness of person and apparel and rooms. Most frequently uncleanliness and deficient ventilation are in active co-operation.

**Planning of Schools.** In planning a school, the essential point is to arrange the rooms so that scholars can be seated in the best position for being taught. The Education Department specifies that a minimum floor-space of 10 square feet shall be provided for each pupil. The proper width of a schoolroom is from 18 to 22 feet. Class-rooms must never measure less than 18 by 15 feet. The use of movable partitions is deprecated, and each class-room ought to be able to be cleared without disturbing any other room.

Entrances should be separate for each department of a large school, and the principal entrance should never be through a cloak-room.

Staircases should be fireproof, not triangular or winding, and the flights should be broken by landings at about every fifteen steps, in order to prevent serious falls. The outer door should open outward toward the street, to prevent a block in case of panic, and the doorway should always be wider than the stair leading to it.

Cloak-rooms should not communicate directly with school-rooms or class-rooms. There should be sufficient hanging-space to provide a separate peg for each pupil; and for this purpose hat-pegs should be 12 inches apart, numbered, and in two tiers. There should be a system of umbrella-drainage, channels running along the cement floor to carry the drippings out of the cloak-room. Hot-water pipes should run under all the compartments, in order to dry and warm each coat and hat, or other heating appliances be employed. The cloak-room must be well ventilated on two sides, to carry off the vapour from wet clothing.

Lavatory basins, with water supply, towels and soap, are now provided in all well-regulated day schools, and are in fact laid down in the Education Department's requirements, though no proportion to the number of pupils is stated. They should be placed in a room adjoining the cloak-room, and the minimum number should be 1 to 75 children, a separate towel being provided for each basin. To prevent bad smells from these lavatories, the waste-pipe under each basin must be trapped by a siphon bend immediately under the basin, and the waste-pipe then made to discharge over a trapped gully in the yard.

**Sanitary Arrangements.** It is assumed that in the majority of schools the water-closet system is practicable. This is certainly the most cleanly and least troublesome. In large day schools it is better to arrange water-closets at a short distance from the main buildings. Where this is impracticable, the closets should be separated from the school buildings by a corridor having free cross-ventilation.

The following table shows approximately the number of closets required, according to the Education Department's requirements:—

| | For Girls. | For Boys. | For Infants. |
|---|---|---|---|
| Under 30 children. | 2 | 1 | 2 |
| ,, 50 ,, | 3 | 2 | 3 |
| ,, 70 ,, | 4 | 2 | 3 |
| ,, 100 ,, | 5 | 3 | 4 |
| ,, 150 ,, | 6 | 3 | 5 |
| ,, 200 ,, | 7 | 4 | 6 |
| ,, 300 ,, | 8 | 5 | 7 |
| | | Urinals in proportion. | |

There must always be separate provision for teachers, and for the two sexes. The best form of closet-pan is the simple *wash-down*, of which there are many excellent forms in the market. *Trough closets*, in which there is a water-tight trough with a number of seats above it, the contents of which are emptied only at long intervals, are particularly objectionable. Each water-closet should have a separate flushing cistern. If water-closets are required above the ground-floor, the soil-pipe must be of drawn lead, and carried up above the eaves full-bore for ventilation. All drain-pipes must be laid on a bed of concrete to prevent sinking, and must be absolutely water-tight. A diameter of 4 inches is sufficient, unless for drains receiving the discharges of more than ten closets. The fall should be at least 1 in 30 for 4-inch and 1 in 40 for 6-inch drains. An inspection chamber must be provided at each change of direction of drains, to facilitate cleansing if this is required. Near the junction of the school drain with the main sewer must be placed an intercepting trap, to which access is obtained by an inspection chamber securely covered. On the school side of this trap is placed an inlet-ventilator, the upper end of which is a little above the ground-level, as far from buildings as practicable; while the soil-pipe ventilator mentioned before serves as an outlet-ventilator—the two ventilators together securing a free current of air through the school drain, quite separate from the ventilation of the main sewer.

It has been assumed in the preceding remarks that the school is situated where a main system of sewerage is available for the discharge of the school drainage. The Education Department mentions cesspits and privies, stating that they must be at least 20 feet from the school. No well-organised school will possess either of these, earth or ash closets being preferable where there is no sewerage system, and slop water being disposed of by irrigation on land.

*Urinals*, when not properly constructed and kept, are a frequent source of nuisance. The essential requirements of a urinal are, that it shall have no angles or recesses, that its surface shall be absolutely smooth, and that it shall be frequently scrubbed by a broom, as well as automatically flushed.

Next we come to the essentially important questions of

LIGHTING,
VENTILATION, *and*
WARMING

of the school, after which a few remarks as to school furniture, so far as it affects the health of scholars or teachers, will bring my necessarily discursive lecture to a close.

**Lighting.** There is an old proverb stating that "where the light cannot come the doctor must," which enforces a great truth. This is true so far as general health is concerned. Darkness and disease are closely associated. It has recently been shown by accurate laboratory experiments

BRITISH MUSEUM

that the best germicide for the germs of such diseases as tuberculosis and diphtheria is bright sunlight. Small windows, with Venetian blinds still further diminishing the best light coming in from the top of the windows, are commonly found in schools; and the general gloom is too frequently increased by dark furniture and dark-painted walls. Varnishing the walls greatly improves the lighting. The injurious effect of a badly-lit schoolroom is increased by the more frequent employment of lamps or gas, which add further impurities to the air.

Every part and corner of each room in the school should be well lighted. The light should, as far as possible, and particularly in class-rooms, be admitted from the left side of the scholars—a rule which will greatly influence the planning of the school. In this direction the incoming light does not dazzle the scholars' eyes, nor does the hand prevent its access to the manuscript or book. This rule does not imply that no other windows are to be provided. Windows on opposite sides of a schoolroom are most valuable for cross-ventilation.

It is not necessary for me to consider the evil effect which deficient and ill-directed lighting while engaged in schoolwork has upon eyesight. This will receive attention in another lecture. I content myself with stating the main rules as to lighting a schoolroom.

As to the *amount of light* to be admitted. This can never be too great, so long as the direct rays of the sun are not allowed to dazzle the eyesight. Reading is most easy in the open air, where there is a uniform and shadowless light; and as any illumination of a room falls short of this, the rule is to admit as much light as possible. Windows should reach from about 4 feet above the floor nearly to the ceiling, as the best light comes from the highest point. Furthermore, large spaces between the window-heads and the ceiling are productive of foul rooms. The cheerfulness of a schoolroom depends largely on the amount of sky that is visible. The piers between the windows should be bevelled, so as not to obstruct the light; and blinds should only be tolerated when they are necessary to mitigate the direct rays of the sun. The necessary proportion between window-space and floor-area has been variously stated as from one-fourth to one-tenth of the floor-area of the room. The nearer one can get to outdoor conditions the better.

The *surroundings* of the school will largely determine the amount of window-space necessary. The distance of any neighbouring buildings should be at the very least twice their height. Cohn's investigations long ago showed that the narrower the street in which the schoolroom was situated, the higher the opposite houses, and the lower the story in which the lessons were given, the more numerous were the cases of myopia (near sight) among the elementary scholars.

In the accompanying diagram is shown a school of three stories, in a street in which the opposite houses, A, are of the same height as the school. It is obvious that the lines A C divide each room into a region of greater and less illumination, according as direct skylight is received, or merely this diffused and reflected. If time permitted, it could be shown that the intensity of the light varies with the arc of sky visible at any given point in the schoolroom.

Of *artificial lighting*, the main point to remember is, the less it is had recourse to the better. If the electric light is unobtainable, and gas is the illuminant, a plan should be adopted which allows the products of combustion to escape from the room through the ceiling, thus aiding its ventilation.

**Ventilation.** The following directions of the Elementary Education Code may be quoted in full:—

"Apart from open windows and doors, there should be provision for copious inlet of fresh air; also for outlet of foul air at the highest point of the room: the best way for providing the latter is to build to each room a separate air chimney, carried up in the same stack with smoke flues. An outlet should have motive power by heat or exhaust, otherwise it will frequently act as a cold inlet. The principal point in all ventilation is to prevent stagnant air. Particular expedients are only subsidiary to this main direction. Inlets should provide a minimum of 2½ square inches per child, and outlets a minimum of 2 inches. Rooms should, in addition, be flushed with fresh air from windows about every two hours.

"A sunny aspect is especially valuable for young children, and important in its effects on ventilation and health. Although lighting from the left hand is considered so important, ventilation in summer demands also the provision of a small swing-window, as far from the lighting as possible, and near the ceiling."

Fresh air is a prime necessity of life and health. We all know that foul air in a concentrated condition is a virulent poison. It is not, however, sufficiently recognised that minor degrees of respiratory impurity, when exposure to them is protracted, undermine the health, causing anæmia, a tendency to coughs and to consumption, and various other evils. The yawning and somnolence observed in schools (as also in churches) are frequently the result of the bad atmosphere rather than of the sedative effect of the teaching.

Perhaps the best test of the purity of the air of the schoolroom—certainly the readiest to apply—is the "stuffy" smell perceptible on entering the room direct from out-of-doors. If the windows or walls are "steamy," the evidence of a polluted atmosphere is still stronger, and free perflation of air is urgently required.

We have seen that the Education Department requires 10 square feet of floor-space for each child in average attendance. Allowing 12 feet for height, this means a cubic space of 120 cubic feet per scholar. If we assume that children, on an average, produce ·6 cubic foot of carbon dioxide ($CO_2$) per hour—the associated organic pollutions being fairly pro-

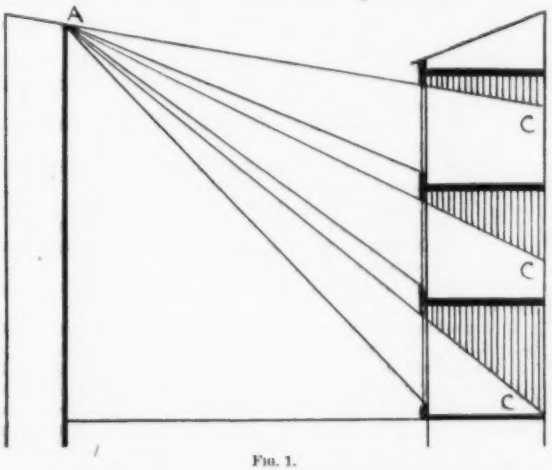


Fig. 1.

portional to this—and if it be granted that the air of the schoolroom should not contain more than 1·3 volumes of $CO_2$ in 1,000 volumes (a comparatively low standard, adopted by Carnelley), it follows, as can be proved by an easy calculation, that every scholar should be supplied with at least 660 cubic feet of air per hour. This understates the real requirements, but one is bound to look at what is practicable under ordinary conditions rather than at what should on sound principles be given. The problem is how to supply this amount of air to every 10 square feet of floor-space (occupied by one child) without producing such a lowering of the temperature of the room or such other inconveniences as will lead to the closure of the ventilating openings.

In summer weather nothing is easier. Keep the windows and doors open, on opposite sides of the room, and a free current of air is produced without inconvenience. The same thing would, under similar conditions, happen in winter, with even greater facility, because the rapidity of movement of air depends largely on the differences of temperature between the two masses of air concerned. But such currents of cold air produce "draughts," to which every one objects; and notwithstanding louvre ventilators, Sheringham's valves, Tobin's tubes, and numerous other similar arrangements, it still remains true that, for a large part of the year, the air of schools which trust to natural ventilation is in a very foul condition. Such natural ventilation will suffice for private houses, especially where it can be supplemented by

open fires. But when a large number of children are closely aggregated in a very small space, no system of ventilation which does not provide for warming the incoming air produces in the winter months a satisfactory result. The case can be met only by *warming the incoming air*. It is irrational to admit cold air, thus causing serious discomfort to all sitting near the points of its entry, and then proceed subsequently to warm the cold air by means of hot-water pipes or otherwise. We all know that this ends in practice in closure of ventilating openings, and then mere re-warming of air which has already been breathed and rendered impure. Re-breathed air in the schoolroom is even more objectionable than re-cooked food in the dining-room. And yet the Government regulations do not so much as mention, in connection with ventilation, the necessity for warming the entering air.

**Warming.**

At this point I introduce the most recent regulations of the Education Department as to warming, though they leave much to be desired, as they scarcely recognise the importance of the fundamental principle on which I have for many years laid stress—that warming and ventilation should form part of a common process.

The following are the regulations in question :—

"The warming should be moderate and evenly distributed, so as to maintain a temperature of from 56° to 60°. When a corridor or lobby is warmed, the rooms are more easily dealt with, and are less liable to cold draughts. Where schools are wholly warmed by hot water, the principle of direct radiation is recommended. In such cases open grates in addition are useful for extra warming occasionally, and their flues for ventilation always.

"(*a*) A common stove, with a pipe through the wall or roof, can, under no circumstances, be allowed. Stoves are only approved when—

"(i) Provided with proper chimneys (as in the case of open fires) ;

"(ii) Of such a pattern that they cannot become red-hot, or otherwise contaminate the air ;

"(iii) Supplied with fresh air, direct from the outside, by a flue of not less than 72 inches superficial ; and

"(iv) Not of such a size or shape as to interfere with the floor-space necessary for teaching purposes.

"(*b*) A thermometer should always be kept hung up in a school."

It is evident that the method of warming here chiefly contemplated is by means of hot-water pipes or steam, on the "direct radiation" principle. When such hot-water or steam pipes are arranged without any provision for the entry of air over them which is warmed in transit, we must condemn them *in toto*. The system has been described in America as "one of the most killing systems in existence." The only legitimate plan is to combine the warming with the admission of fresh air. What is wanted is an abundant supply of air at a temperature not lower than 55° and not higher than 65°. Such *warm air is expensive*, but it is worth the money, for the teacher is amply repaid in improved health and in increased power of work for both scholars and teacher.

Having stated the main principles of combined ventilation and warming, it is clear that the application of these principles will vary greatly according to circumstances. In small schoolrooms we may trust to natural ventilation through windows, doors, and Tobin's tubes, combined with admission of fresh warm air which has passed alongside the flue of a Galton's stove, or a Hygiastic or a Shorland's Manchester stove. A sufficient exit for foul air is provided in such small rooms by the open fire, combined with an opening into the chimney-breast, which leads into a small separate flue running up alongside the chimney flue, and communicating similarly with rooms on each floor of the building.

In every instance one ought not to trust solely to any system of ventilation, but to throw doors and windows—top and bottom—widely open in the intervals of school work, so as to secure liberal perflation of fresh air.

The Education Code's requirements as to size and position of air-inlets for each child (2½ square inches) may be further criticised. If we assume that 660 cubic feet of air are required by each child per hour, the above size of opening requires that the entering air shall be travelling at the rate of 10·6 feet per second, or 7½ miles per hour—a rate which is unbearable at the winter temperature. Then we are told that the outlet for foul air must be at the highest part of the room. This is correct, when dependence is placed upon the natural operation of open windows, etc. If, however, the incoming air is warmed—and it should be—the top of the room is the very worst place for discharging it.

Take, for instance, a case where the inlet is a Tobin's tube, or similar arrangement, the air passing through which is warmed by a steam coil about 5 or 6 feet above the floor-level, and the outlet is into the chimney-breast near the ceiling. Then the state of things shown in Fig. 2 is produced.

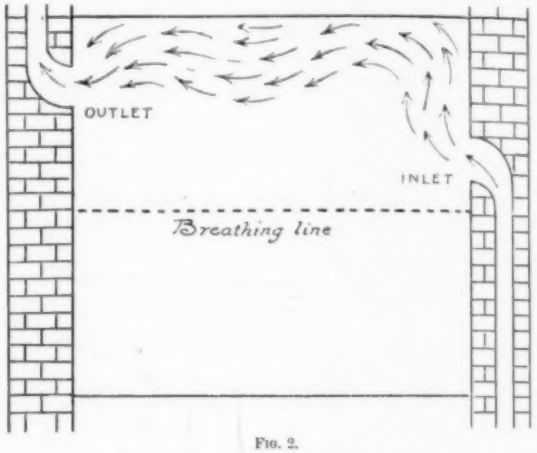


Fig. 2.

It is evident that there is an upper stratum of pure air, and a lower stratum of comparatively impure and stagnant air.

Even with inlet and outlet at opposite sides of the schoolroom on the floor-level, complete circulation of air is not secured, as shown in Fig. 3.

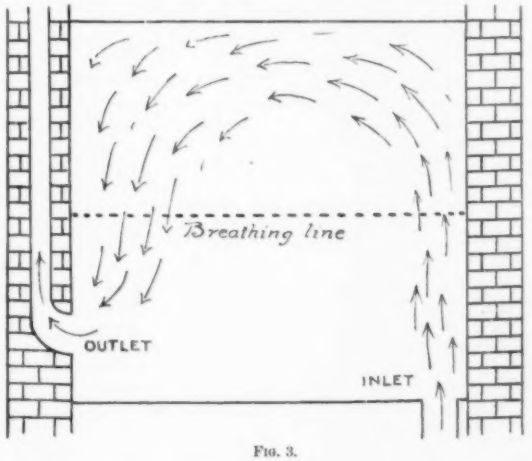


Fig. 3.

The best relative position of inlet and outlet with mechanical ventilation is shown in Fig. 4.

Dr. Wheatley of Blackburn has given the following important figures on this point, derived from an examination of the air in seven elementary schools :—

| | Square inches of inlet and outlet per head. | $CO_2$ per 1,000 of air. |
|---|---|---|
| School No. 1..... | 6·48 | 2·0 |
| ,, ,, 2..... | 2·88 | 1·0 |
| ,, ,, 3..... | 2·88 | 2·3 |
| ,, ,, 4..... | 2·16 | 1·6 |
| ,, ,, 5..... | 7·92 | 1·5 |
| ,, ,, 6..... | ... | 2·1 |
| ,, ,, 7..... | 6·48 | 1·4 |

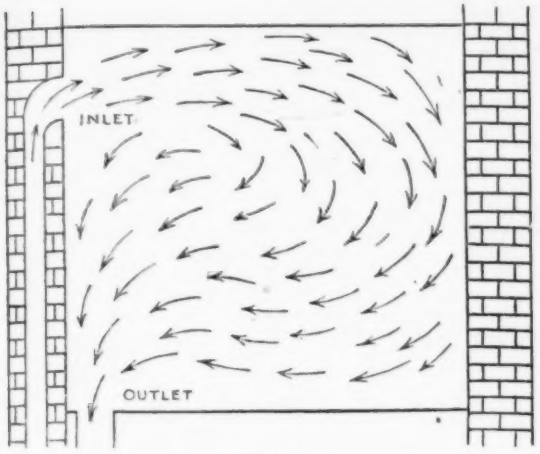


FIG. 4.

It is clear that a much larger area for ventilating openings is required than that given by the Education Code; and that to attempt to admit cold air through these, means that the openings will speedily be blocked up.

Now imagine what will happen in the system recommended by the Code, in which an outlet is arranged with motive power by heat or exhaust. The exhaust-fan is placed somewhere in the ceiling, while fresh air enters by Tobin's tubes, open windows, etc., and travels directly towards the exhaust, leaving the lower stratum of the schoolroom in its condition of respiratory impurity.

In large schools natural ventilation, even supplemented by the admission of warmed air from such stoves as Shorland's or Galton's, cannot be trusted to provide a sufficiency of warmed pure air. The children are closely aggregated together on a part only of the average floor-space which the minimum standard of the Education Department accords to each child.

Professor Carnelley of Dundee made a most exhaustive investigation of this question, and, at the risk of giving somewhat wearisome figures, I reproduce here his most important results.

| Mode of Heating. | Schools. | Rooms. | Cubic Feet per Person. | Per Cent. of Windows Open. | Temperature. In. | Temperature. Out. | Volumes $CO_2$ in 10,000. | Micro-Organisms per Litre. Bacteria. | Micro-Organisms per Litre. Moulds. |
|---|---|---|---|---|---|---|---|---|---|
| Mechanical ventilation by warmed air | 6 | 32 | 160 | 1·5 | 58·6 | 40·1 | 12·3 | 17·5 | 1·0 |
| Natural ventilation and hot pipes | 17 | 43 | 176 | 37·9 | 58·4 | 46·4 | 16·3 | 96·5 | 1·1 |
| Natural ventilation and open fires | 33 | 84 | 145 | 30·0 | 58·4 | 44·8 | 19·2 | 153·2 | 4·8 |

It is clear that the mechanically ventilated schools were superior to those in which natural ventilation was in vogue, both as regards comparative freedom from carbon dioxide and micro-organisms.

I have already mentioned the importance of cleanliness of children as affecting the purity of the school atmosphere. It is interesting to find, therefore, that Carnelley found experimental confirmation of this fact; the number of micro-organisms in the air of the schoolroom being proportional to the cleanliness of the children and of the rooms, as shown in the following table:—

| Degree of Cleanliness of | Clean. | Medium. | Dirty. |
|---|---|---|---|
| Children .... | 63 | 99 | 159 micro-organisms |
| Rooms ..... | 85 | 94 | 139 per litre of air. |

My friend Dr. Kerr, the medical officer to the School Board for Bradford, has independently investigated this subject, and has arrived at the results shown in Fig. 5. This shows the proportion of carbon dioxide in school air in different rooms at various times in the afternoon, the amount in the playground, taken at the same time, being stated as equal to 100. "Over 250 separate estimations of $CO_2$ were made, most of them being done in clear, calm weather during September 1897. Using the atmospheric $CO_2$ as a standard (=100), the proportion of $CO_2$ in the air, at $2\frac{1}{2}$ feet from the floor in the centre of mechanically ventilated class-rooms, was found to be maintained steadily throughout the afternoon at about 200, increasing towards the extraction-shaft, and increasing also in amount at higher levels in the room. In naturally ventilated schoolrooms in similar positions, at 2 p.m. it stood at 200, increasing to about 500 by 3 p.m., with a slight remission during the interval for play, and then showing a gradual increase to about 700 by the time of dismissal. Wide variations were found in the naturally ventilated schools, the worst recorded being (=972) at 4 p.m."

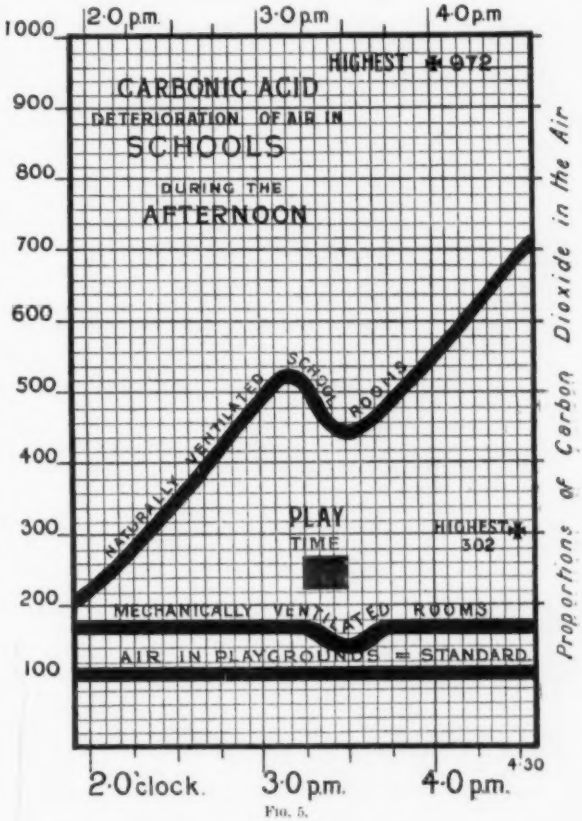


FIG. 5.

DIAGRAM,

*Showing the fouling of school air during the course of the afternoon.*

Compiled from 250 estimations of the carbon dioxide in the air taken at a height of $2\frac{1}{2}$ feet from the floor, about the middle of various school class-rooms, and compared with the air taken in the playgrounds at the same time. Still clear weather in September 1897. (Signed) J. KERR, M.D.

**School Furniture.** Much of the comfort of school life depends on the adoption of the best forms of desks and seats, blackboards, etc. Bad postures during school work, and especially the twisted position, with the left arm resting on the desk during writing, help in the production of lateral curvature of the spine, particularly in rapidly growing girls. Round shoulders and flat chest, impeding the functions of heart and lungs, are also favoured by the cramped position induced by defective desks and seats; and the habit of leaning forward close over the copy-book or

reading-book, necessitated by such badly-arranged seats and desks, may produce short-sightedness, which in its turn increases the necessity for the improper postures. Thus a vicious circle is entered, each evil mutually intensifying the other.

On the contrary, it is well to remember that even the best arrangements of desks and seats will not obviate the evils associated with long continuance in one posture. A few minutes' interval during a writing lesson, devoted to arm exercises, will always be beneficial in securing upright postures, and at the same time will improve the quality of the school work.

The following are the recommendations of the Education Department as to desks:—

"Benches and desks, graduated according to the ages of the children, should be provided for all the scholars, and placed at right angles to the light.

"An allowance of 18 inches per scholar at each desk and bench will suffice (except in the case of the dual desk), and the length of each group should therefore be some multiple of 18 inches, with gangways of 18 inches between the groups and at the walls. In the case of the dual desk the usual length is 3′ 4″, and the gangways 1′ 4″.

"(*a*) The desks should be *very slightly* inclined. An angle of 15° is sufficient. The objections to the inclined desk are, that pencils, pens, etc., are constantly slipping from it, and that it cannot be conveniently used as a table. The objection to the flat desk is, that it has a tendency to make the children stoop. A raised ledge in front of a desk interferes with the arm in writing.

"(*b*) No benches and desks, three rows deep, should be more than 12 feet long, nor, when four rows deep, more than 9 feet long. And no group of long desks, in a schoolroom providing for more than sixty children, should contain more than four rows of benches and desks even when the width is more than 21 feet 6 inches, *because in proportion as the depth is increased, the teacher must raise his voice to a higher pitch; and this becomes exhausting to himself, while at the same time it adds inconveniently to the general noise. With the use of the dual desk the space between seat and desk disappears, as the children stand in the gangways.*"

The above quotation from the Elementary Education Code shows that the idea of dual desks, or even of long desks for six to nine scholars, is entertained. From a teacher's standpoint, especially if the class is a large one, there is much in favour of this; but hygienically there are grave objections to such desks, and the most satisfactory plan is to have a single desk and seat for each scholar. This would ensure a purer atmosphere and a much slighter risk of contagion than with dual or longer desks. The single desks would also *keep down the size of the class.* The necessity for this applies particularly to elementary schools. Classes of sixty or seventy children are not uncommon even in the best Board schools. There is a tendency for the size of the class to grow. Not only does this produce an injurious strain on the teacher's voice and powers, but it prevents him from giving such individual attention to his scholars as good teaching demands. The class should not exceed forty, or at the outside fifty scholars.

Next, as to the slope of desks, I am of opinion that 30° is preferable to 15° for writing, and that the angle should be increased to 45° for reading.

No particulars are given in the Code as to other important points. The *distance* between the front edge of the seat and a vertical line dropped from the edge of the desk should, for writing purposes, equal zero, or be a small negative quantity. The *difference* between the height of seat and desk should equal the length of the forearm, or about one-sixth the height of the scholar, when it will be found that the under part of the forearm will rest comfortably on the desk top.

The height of the seat should correspond to the length of the scholar's leg from sole of foot to knee. The seat should be at least eight inches wide.

**Dormitories.** Of the schools in which my audience are interested many are boarding-schools, and a few remarks may be made as to school dormitories. Of course, the 120 cubic feet, which is the minimum required for the schoolroom (of which only 12 feet must be in height, any height above this being disregarded), must not be considered sufficient for bedrooms. Even though a complete system of mechanical ventilation were in force—and such a thing is practically unknown in school dormitories—a floor-space of only 10 square feet would imply such close contiguity of beds as is objectionable on every score.

In common lodging-houses for the poorest classes from 300 to 350 cubic feet of air-space is enforced for each person. Dr. Dukes of Rugby School urges that, taking a school-bed at 3 by 6 feet, the superficial area allowed for each pupil should be 6 by 12 feet, and the room 12 feet high. This gives 864 cubic feet per head. The poor health and pale appearance of children at boarding-schools are much oftener due to overcrowded bedrooms than to insufficient or inferior food, or to overwork.

Bedrooms should never be used as studies, and closed cubicles are very undesirable.

It would be quite easy to extend this lecture by entering into various miscellaneous requirements of school life. A fresh branch of the subject of school hygiene would be opened out were we to discuss the mental hygiene of school work, or the extremely important question of the prevention of infectious diseases in relation to school life. I have, however, confined my remarks to the more prosaic and less interesting problems involved in the construction and management of schools. The problem of the ventilation of schools towers above all other problems in importance. It is the main question of school hygiene, and if it be solved, healthy and efficient school life is ensured. In solving it, the warming of the school must necessarily be considered, and the best solution is found by a combined system of ventilation and warming.

It is hardly necessary to remind you, in conclusion, that the function of school education is to prepare a child for his after-life, and the true test of the value of an educational course lies in whether it fulfils this end or not. In educating the mental and moral we must not neglect the physical parts of a child's nature, if an ill-balanced and defective manhood is not to be produced. These different parts of our nature are inextricably associated, and defects in one react injuriously on the others. From this standpoint the commonplace subject which I have had the honour to bring before you to-day is of prime importance to the success of your great work.

## MR. SADLER'S SPECIAL REPORTS.

VOLS. II. AND III.

### The Teaching of Modern Languages.

IN putting the case for the study of modern languages, a witty Frenchman is credited with the following overstatement of a certain truth—to wit, that from the study of modern languages is to be obtained, not only the mere utilitarian power of trafficking with foreign folk at an advantage, but also a humanising influence telling unmistakably and greatly for culture. Our Frenchman claims more than this in saying that "*l'homme est autant de fois homme qu'il possède de langues différentes.*" Still there is a sufficiency of truth in the hyperbole to justify the movement in favour of more and better language teaching in our higher-grade and secondary schools, and to justify also Mr. Sadler in devoting thirty pages of his second volume, and about one hundred pages of his third volume, to the consideration of the what and how of modern language teaching.

### I. The Direct Method of Belgium.

In dealing with the question of language teaching in Belgium, special stress is laid upon the *direct method*, which allows no language to be used during the lesson other than the one under study. In the first place, it is to be observed—and Miss Montgomery, the writer of the paper, admits it—that to compare the teaching of French in England or Germany with the teaching of French in Brussels

or Antwerp, is to compare two totally different things. This was put very plainly two or three years ago by

**The Teacher-Novelist, Mr. I. Zangwill,**

who, in describing a visit to the Antwerp Exhibition, very truly says that "Antwerp is very strong linguistically. The *quatre langues* — Flemish, French, English, and German — make a universal confusion of tongues, and the whole town is nothing but

**A Huge Open Flemish-French Dictionary,**

every shop sign or street name being translated." This fact discounts very materially the success to which Miss Montgomery refers, as it is more than probable that much of the progress is due to the natural imitation, conscious and unconscious, of what is heard outside the four walls of the schoolroom.

In her remarks on the teacher, the writer discusses

**(a) His Nationality,**

rightly agreeing that he should be a native and not a foreigner, this being the one thing with respect to which all reformers have come to an agreement, as will appear from what is said under this head in the German section. The native teacher must, of course, have acquired his foreign language at the fountain-head—that is, in the country to which the language belongs. To this end, scholarships must be forthcoming, and the writer records the fact that 2,000 francs "are given to young doctors of philosophy, letters, law, and medicine who have specially distinguished themselves at the universities, to enable them to study for another year or two in a foreign country;" and that it is in contemplation to set apart "scholarships of about 400 francs for teachers actually engaged in teaching modern languages, to enable them to attend the summer meetings in foreign countries in greater numbers."

**(b) His Training.**

There is no doubt that the best thing under this head would be the realisation of the idea just referred to, and it is to be hoped that England will either grant travelling scholarships, or come to some

**Mutual arrangement**

whereby Englishmen may have the benefit of residence and tuition in foreign countries, in return for a like privilege extended to the stranger within their gates.

The authoress sketches the Belgian system of training for both primary and secondary teachers, and then proceeds to outline the special training that is given to the would-be modern language teacher; but as the best features of this training are referred to at greater length in the reports on German modern language teaching in the third volume, we will say nothing further on this subject, except to quote Miss Montgomery as to the meaning of the direct method, and to reproduce her account of an actual lesson that was given in a school at Brussels.

**Direct Method: Official Exposition.**

"The teaching of the second language (French or Flemish, according to the locality) should be given by the direct or natural method. This method consists in teaching a foreign language without having recourse to translation, except in special cases, and even then a direct and intimate connection should be always maintained between words and ideas. The lessons should deal with things familiar to all the children (the family, clothes, furniture), or with things which have already been made the subject of lessons in the children's own language. Thus the whole attention can be concentrated on correct pronunciation and the construction of the sentences. Care should be taken to keep before the children the objects which are mentioned, either by models, by pictures, or by blackboard illustration. To make the verbs intelligible, the actions spoken of should be performed as far as possible. With regard to adjectives, several objects should be shown which contain common qualities. In a word, the teacher should proceed, as far as possible, by the best of all methods—namely, that which a mother intuitively uses in teaching her children to speak."

**Model Lesson**

given to children aged nine at a Brussels École Communale:—"A large coloured picture of a goat was put up, and in clear, rather loud tones, marking the syllables distinctly, the teacher asked, '*Mes en-fants, que voy-ez vous?*' Numberless hands went out, and a child being indicated, answered, '*Une chèvre.*'

"'*Non, ce n'est pas une réponse, il faut une phrase.*' At once the child corrected herself—'*Mademoiselle, je vois une chèvre.*' Then talking in French with great animation, but slowly, the teacher drew out every possible fact about the goat, always insisting on complete sentences as answers, and gradually adding new words round the original phrase as a nucleus. It was an

**Object Lesson,**

but primarily a language lesson, and brought home very clearly how much translation can be avoided by the use of gesture and pointing. Each part of the animal was thus named, always giving, if possible, not only the article, but an adjective—for example, 'How many legs has the goat?' Then pointing, '*Voilà! une jambe, deux jambes,*' etc.; then adding, still pointing, 'Two fore legs, two hind legs. Now what are these two legs called?' And a child would answer, 'These two legs are called the fore legs.' Then action was spoken of, and the difference between *walking* and *climbing* was explained in French and by action: 'I *walk* across the room; the goat *climbs* up the rock.' Then different words for eating: 'We *eat;* the goat *browses.* We have a mouth; animals have beaks, snouts, muzzles, etc.' The difference between *poil* and *cheveux*, between *foot* and *hoof*, was drawn out, different children giving instances, always in a complete sentence; so that by constant repetition of the same words, in different connections, the children learned them not merely by rote, but *in use*, and they became so familiar that they sprang to their lips, with no pause at all for thought. The teacher encouraged the children to draw on their own experience, telling what they themselves had seen: 'Where have you seen a goat? Was it a white goat?'—and so on. The whole time French only was used; not once did the teacher use a Flemish word in explanation. Again and again came the question, 'Can you put that in other words?' And here I saw the wisdom of emphasising the study of synonyms. Once or twice a child was called up to write a word on the blackboard, and a new word would be written by the teacher. A little grammar was taught incidentally as it arose out of the lesson; thus, if a child omitted the *s* in the plural, the teacher would ask the class, 'Is that right?' and when the mistake was corrected, the teacher would say, 'Why do we put *s*?' and the answer would be, 'We put *s* because there are several'—not the mechanical phrase, '*s* is the mark of the plural.' And similarly, genders were simply corrected. 'We say *la* table and *le* livre;' so that when later on the child learns the rules of grammar, they will have a meaning for him, because he already knows them in action."

We have given this outline lesson as best calculated to explain and illustrate the *modus operandi*. To those teachers who would fain make trial of this direct system of teaching French we recommend

**"La Méthode Naturelle,"**

a book recently published by the Messrs. Nelson, which proceeds exactly on the lines laid down in the above lesson, and which we, from many years' experience in teaching French, hail as a

**Veritable Teacher's Aid,**

which, supplemented by Mr. Cran's *Object Lessons in French* and the connected Picture Sheets, would put the English modern language teacher on an equality with his Belgian, Dutch, or German compeer.

**II. Holland.**

Miss Montgomery visited Holland as well as Belgium. In her preliminary note she puts the case as to the training

of teachers very tritely when she says that "no one can teach without a diploma," which, however, can be obtained by examination alone; "indeed, for secondary teachers no training college exists." The information gleaned by Miss Montgomery is summed up as follows:—

1. In the Hoogere Burger Schooden the time given to languages seems to be much the same for boys and girls.

2. French is the first language taught, and has most time devoted to it; then comes German, and lastly English—which surprised me, as certainly in daily life English seems most used.

3. The time devoted to each language per week seems usually from three to four hours during the first three years, and from two to three hours in the two final years.

4. In all the programmes of study that I have seen, the language is studied during the first three years, and only in the fourth year is the literature and history of literature taken.

5. While, especially in the case of French, speaking is insisted on, translation (from and into Dutch) plays a much larger part in all the programmes of study than in Belgium; but, so far as I could judge from the lessons I heard, practice is being largely modified in this respect, and is ahead of theory.

6. In nearly every case the first place in the study of English is given to *pronunciation*.

The writer goes on to state that everywhere in Holland

**Progress in English is quicker than in French.**

This we can corroborate from actual experience; nay, we will go further, and say that, so far as facility of expression in English is concerned, the Dutch are far and away ahead of the Germans, and the interest is not only in the language *qua* language, but also in the literature. A striking proof of this latter fact came under our notice last August when travelling in Holland. In our compartment (third class) were at least three men who could speak English, with one of whom we had a most interesting chat on English literature, in the course of which he incidentally displayed an intense

**Hero-worship for Dean Farrar,**

whose books he had read, whose portrait he possessed, and with whom he had exchanged letters. Again, at Enscheda, on the German frontier, we met an intelligent young Dutchman, engaged in the cotton trade, who spoke English fluently, although he had never been in England. Of course the likeness between the two languages is very striking, which materially assists the budding linguist and encourages him to persevere.

## III. Germany.

In the third volume much space is devoted to the question of modern language teaching, as understood by the Germans, who, as the author (Mr. Fabian Ware) informs us, estimate the teaching of modern languages in England at a very low value indeed, the much-vaunted Gouin series being thought but little of. Frankfort-on-the-Main is credited with the maximum of progressivism in this connection, the special accomplishment being the postponement of the commencement of Latin in the Gymnasium and Realgymnasium to the fourth class from the bottom, and that of Greek in the Gymnasium to the sixth from the bottom, by which reform the three lowest classes in all their secondary schools—namely, Realschule, Oberrealschule, Realgymnasium, and Gymnasium—have a common basis of instruction. This leaves the ground clear for the introduction of modern languages, French being the one most commonly preferred, especially in the Realgymnasium and Gymnasium, where Latin is taken, to which language French is regarded as an excellent introduction. We shall not attempt to deal with the papers—four in number—*in extenso*, but will seek rather to make clear what is done, and what is to be recommended for adoption here.

**Translation from the Mother Tongue into the Foreign Language.**

This is condemned as utterly wrong, and the condemnation must be sustained by all who have given thought to the teaching of modern languages, where we should above all try to avoid the slow process of first of all getting the meaning that one intends to convey set out in English, and afterwards proceeding to translate this mentally into the foreign idiom. Such a method must perforce be halting and unnatural; whereas, if the meaning is expressed directly in the foreign tongue without the intermediation of the vernacular, progress may be slow at first, but it will be speedy anon, and always it will be sure. We must, then, postpone translation

**From English into French**

to that stage in the pupil's progress when he is facile in speech. This may appear a hard saying, but it is nevertheless true; hence, in the elementary stage even, and much more in the junior and senior stages, "the acquisition of facility in answering in the foreign tongue, from a known vocabulary, *without any conversion, either actual or mental, into the mother tongue*," must be steadily aimed at.

Then, again, as to the nationality of the teacher, the German reformers are unanimous and decided in their conviction that

**No Foreigner need apply**

for the post of modern language master. "Attention is drawn to this fact because many English parents still imagine that their children must learn a foreign language from a foreigner, and that the contact with anything but a Parisian or Hanoverian accent is fatal to their future command of French or German. The Germans, on the other hand, know that a boy cannot possibly be taught at school to speak a foreign language perfectly; that an absolutely correct pronunciation, a complete acquaintance with the idiom, can only be acquired, with permanent results, by residing in later life in the country where the language is spoken." They therefore support the opinion of their educational authorities, that their boys can be best taught what is requisite and of greatest importance by

**Their own countrymen,**

who have been trained in the methods approved in Germany, are in thorough sympathy with their pupils, and are able to introduce them to the life and ways of other nations as no foreigner can do. It follows from this that the teacher must have resided in the country whose idiom he professes to teach; which residence, as Dr. Hausknecht—whose scholarly paper on "The Teaching of Modern Languages" is set out in Vol. III.—rightly contends,

**Must not be cut too short,**

and must be often repeated. Dr. Hausknecht recommends the division of the course into four stages, namely: (1) *Introductory*, to last about four weeks; (2) *Elementary*; (3) *Junior*; (4) *Senior*. During the four weeks of the introductory course the pupil is to be drilled in sound production on scientific lines; in fact, to be able to give this part of the course, the teacher must be well versed in phonetics, especially as to the physiological production of the sounds to be imitated by the pupils. It is further claimed that

**Beginners should have the best Teachers,**

concerning which Mr. Ware well says that "if this [that is, French] is to be taught in the most natural manner possible, the first requirement is that the teacher should be able to speak French fluently. Were this enforced in English secondary schools, many of those at present engaged in teaching French to the younger boys would be disqualified. We are thus, at the very outset, obliged to admit the superiority of this system over that still in vogue in many English schools. Not only is the blunder of entrusting the education of the beginner to an untrained teacher a thing of the past, but the master possessing a mere amateur acquaintance with modern languages, who is in England often told off to teach these to the lowest classes, in Germany is not recognised by the profession as a modern language teacher at all."

### The Three Aims

of the elementary course are set out by Dr. Hausknecht as follows:—

1. The direct comprehension of the foreign word when spoken. The pupil is to learn to think in the language—that is, to acquire an intuitive sense of the language.

2. Practice in the accidence, which is to be no mere parrot repetition of the verb and other forms, but a combination of these with other words to form sentences; for example,—

À l'école j'ai un sac.
À l'école tu as un sac.
À l'école il a un sac, etc.

3. The acquisition of a large store of words and phrases and the most important phenomena of syntax, not through the medium of reflection, but chiefly by imitative and unconscious habit.

Throughout the whole of this elementary course the

### Reading Book forms the starting-point

and the centre of the instruction. The method is *predominantly oral;* all exercises—in conversation, or in grammar, or in written work—are conducted by one and the same teacher. *Translations from the mother tongue into the foreign tongue are entirely excluded during the whole of the elementary course.*

### Thinking in the Foreign Tongue

is to be helped by three devices, namely,—

1. **Hör-übungen**—that is, exercises for training the pupil's ear to catch, and his tongue to reproduce, whole sentences which are mere combinations of old material.

2. **Sprech-übungen,** consisting of answering questions put in the foreign tongue.

3. **Dictation** of passages which are variations on those of the reading book.

Much might be added in elucidation and in illustration of the above, but space considerations forbid, and press us on to a consideration of the

### Junior Course,

which Dr. Hausknecht thus introduces: "After the pupil has, in the elementary course, acquired a certain amount of linguistic feeling or intuitive sense of the language; after he has learned to think in the foreign tongue: after there has been developed in him, to a certain degree, the capacity of answering at once in a foreign tongue questions put in a suitable and easy form, and that without going through the process of converting the question into his mother tongue; after he has mastered the accidence, and after he has absorbed the most important laws of syntax, less by reflection than by habit and unconscious assimilation, there follows the middle stage of the language course," which is,—

1. Primarily, that of reflective language study—

### The Stage of Grammar.

2. Secondly, that of extended conversation practice. Starting from the contents of reading-passages, there will be an intentional breaking away from them to pass to other subject-matter. Hence, be it noted, begins the

### Translation from the Mother Tongue

into the foreign language, which is now of service in giving a firmer grasp and a deeper penetration into the materials of language already known to the pupil, and the grammatical laws contained in them. In a word, the usual (and bad) progress from grammar to language is reversed, and the wiser inductive procedure by way of language to grammar is rightly insisted upon. After there has been imparted in the junior course a deeper insight into the grammar by means of systematic grouping of the grammatical phenomena, and by practising these in translation from the mother tongue, and after the linguistic feeling or intuitive sense of the language has been still further developed, partly by means of

### Dictation

(the passages for which are, for the most part, of unknown contents, but with known vocabulary), and partly by what is most important of all, the extended conversation exercises, then grammar and the exercises necessary for its practice (including translation from the mother tongue) fall again into the background to make room for—

1. An extensive reading of authors.
2. Free written composition.
3. Enlargement of the vocabulary.

In connection with the enlargement of the vocabulary, which we have found to be one of the most irksome of all things connected with language teaching, there is nothing very striking or original in the recommendation of Storm's *Conversation Exercises* and Hölzel's *Pictures*, both of which have been well known to teachers of modern languages in England these many years past. In connection with the articles is an excellent bibliography of books on language teaching—still, alas, in German—to which we recommend a further addition in future editions, in the shape of particulars as to price. We had marked for insertion a lesson, on the lines laid down above, by Dr. Dorfeld, but we must content ourselves with the above exposition of the fact that, with respect to modern language teaching,

### Tempora mutantur,

and will close with the fervent hope that those English teachers into whose hands is committed this most important branch of latter-day education may be able to say with truth, not only

### et nos mutamur in illis,

but also that the change is in the right direction and on right lines, to the end that whatever of truth there is in the saying of the old Frenchman, with which we set out on our dissertation, may be experienced to the full by their pupils, in the which hope we lay aside our pen.

# CONFERENCES WITH PRACTICAL TEACHERS.

BY AN INSPECTOR OF SCHOOLS.

## IV.—THE TEACHING OF ARITHMETIC.

THE teaching of arithmetic is more successful in boys' than in girls' schools. The knowledge of mathematics on the part of the men throws light on the arithmetical processes, and more intelligent work is the result of this higher knowledge.

One would like to see more problematic arithmetic attempted in connection with the mental and written exercises of the children. It is very disappointing for an inspector to be told, towards the close of an educational year, that problems have not been attempted *yet*. This kind of statement gives the teacher away immediately, for children ought to be taught from the first (certainly in boys' and girls' departments) to work out with the teacher simple problematical exercises on the various rules as these are taught. We know that teachers get weary of problems—so do the children—when they find that only two or three in the class get the answer right. There is always something pleasant and exciting for the teachers and children in seeing hundreds of sums marked right. It looks nice to see fifty or sixty slates or books marked right with a big blue or red letter; but too much of this goodness is unwholesome, and disposes teachers and children to live in a fool's paradise where the true nature of intellectual development is not known.

Problems will not be worked successfully if very big numbers are used in the statements. Not long ago we witnessed a good teacher giving a lesson in problems. Her "exposition was most sound," and the whole lesson promised good fruit. When, however, she gave a similar exercise to test the result of her teaching, the response of the class was a complete failure. She could not understand the *fiasco*, and we must confess that we expected to see more correct answers, judging from her style of teaching. The error in teaching was soon discovered, and

when another simple explanation had been given with numbers under twenty, nearly the whole class could work problems of the kind correctly. Deal with small numbers, we should say emphatically, and with small sums of money, weights, and the like, until the children thoroughly grasp the principles on which the exercises are based.

Separate lessons for mental arithmetic are not always successful. The mental arithmetic and the problematic arithmetic should enter into and form part of almost every lesson in arithmetic. One occasionally sees a teacher endeavouring to give mental arithmetic from some book of exercises. No teacher can expect a good mark who has to lean upon crutches in this way. She had better by far allow the children to write out their tables or figures than stand before her class with a mark of incompetency in her hand.

The excuse one receives at times for the non-performance of mental arithmetic or the neglect of problems is that accuracy is being aimed at, and that the time is being taken by the boys and girls for exercise in long, straightforward sums to secure this accuracy. Of course, inaccurate arithmetic is worthless in a commercial sense, and, by all means, correctness in working should be aimed at and admired; but it must not be forgotten that the aim of teaching arithmetic is principally the cultivation of the reasoning faculty, and this aim should be the first, though not the only, consideration of the teacher.

Under the old system, it was not an uncommon thing to find the arithmetic lesson put last on the time table, and we say it with regret that this was done to enable the teachers to exercise an unconscious cruelty on the children. At 11.15 or 11.30 a.m. the girls or boys were set four or five very long sums, and they were retained in school after twelve until they got all of these right. Ill or well, the children had to go through this daily ordeal, sufficient in itself to disgust any child with the study of arithmetic. Even nowadays one sees a little of this practice, and it occasionally happens that one-half or one-third of a class are deprived of their play because they have not got all their sums right. The system of work is wrong where such numbers have to receive punishment for failing in any lesson. One or two delinquents there may be; but when punishment follows teaching to such an extent, the teacher or the system is to blame, and this manifest weakness does not escape the eyes of an inspector.

The neatness of the written exercises should receive due attention, for the *style* of work is always carefully regarded in assessing the value of this subject. The faults of style are due, as a rule, to carelessly-made figures and to disproportions in distances between them. It is very questionable whether chequered paper does not cramp the figures and produce a poor style. Plain, big figures should be taught at first, and good, even distances should be observed. As the children grow older they will then accommodate their work naturally to whatever circumstances require.

A few words addressed specially to the teachers of the infants' departments cannot be out of place here. Sometimes, notwithstanding their thoughtfulness, they weary the children by making their lessons in number too long. Half an hour's mental arithmetic is a great strain on both children and teachers. The lessons should be varied, and the exercises given to the children should be more concrete and various. A nice diversion for the children in an infants' school, and also in the upper departments, is to allow the children to come out and work on the board, with the help of the teacher, before the whole class. The little ones will often pay the greatest attention to the work of one of themselves, when they will take little or no heed of the demonstration by the teacher.

One wonders what would have happened in the teaching of arithmetic if apples and marbles were not known. Surely there is a great world of concrete examples that might be used other than these, but they are not often requisitioned. An inspector on one occasion ventured his questions on *oranges*, and for a time received no replies. Presently, however, a little girl relieved the monotony of his work by answering, "Please, sir, we does 'em in apples."

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# THE COMING PRESIDENT OF THE N.U.T.

## MR. T. CLANCY.

THE "Sage of Chelsea" was of opinion "that the most important social feat a body of men can do is to winnow out the man that is to lead them." The N.U.T. is then to be congratulated, forasmuch as they do in each succeeding year, without any great difficulty, accomplish this feat, and elevate one of their number to the "blue ribbon" of the teaching profession by making him their President. And who, on looking back on those who have occupied the presidential chair—on Macnamara, on Ellery, on Addiscott of blessed memory, on Waddington—can doubt that the choice has been in each case the wisest? What, then, shall we say when the elected one is chosen by such an overwhelming majority as that which Mr. Tom Clancy polled last Easter, when 15,506 of his fellow-teachers awarded him their votes?

Mr. Clancy is of Celtic origin, having been born at Cappaghwhite, Co. Tipperary. His apprenticeship as a pupil teacher was served at Plymouth. He was trained at St. Mary's College, Hammersmith, and on leaving was appointed to the head-mastership of the R.C. Schools at Portsmouth.

Mr. Clancy is an ideal master, loved by his scholars, respected by his staff, and treated with the greatest consideration and confidence by the managers.

He was first elected to the Executive at the Cardiff Conference in 1891. During his eight years' service on the managing body of our Union he has acquitted himself well, and has done yeoman service. He has addressed meetings all over England and Wales, and was the Executive representative at the Dublin Conference in 1893. Mr. Clancy has devoted much time to the attempt to draw into the Union his co-religionists, and with this object in view has issued special appeals to the Catholic teachers, and has addressed numerous meetings. With the late Mr. Addiscott he attended the Conference of French Teachers in the midsummer of 1898, and a few weeks later he was invited to the Conference of Belgian Teachers.

His work as Chairman of the Parliamentary Committee and of the Parliamentary Election Committee won high commendation from all, especially that part of it devoted to interviewing members of Parliament in the lobby of the House. Night after night he was in attendance prior to the introduction of the Superannuation Bill.

In the early part of 1897 Mr. Clancy was appointed on the Departmental Committee on the Training of Pupil Teachers. For his valuable services on this body he received the cordial thanks of the Executive. As the only primary teacher on

the committee, Mr. Clancy was able, from his long experience, to specify the many grievances of our juvenile teachers, and to suggest the remedies. It was on his initiative that the following reasons were embodied in the report as showing the deficiency in the supply of pupil teachers: (1) smallness of ultimate salary; (2) small chance of promotion, owing to increase in size rather than in number of schools; (3) want of an adequate superannuation scheme; (4) insecurity of tenure; (5) imposition of extraneous duties.

MESSRS. ADDISCOTT AND CLANCY.

[A pathetic interest attaches to this snap-shot, which excuses its reappearance in these columns. The photo was taken by Mr. J. Edward Parrott, M.A., LL.B. ("The Silent Member"), when engaged in the work of special correspondence for this Journal. Mr. Parrott says:—"It is, I believe, the last photograph ever taken of poor Addiscott. He, the Vice-President of the N.U.T., my wife, and I were together at the Belgian Teachers' Conference at Malines. Immediately after taking this photograph, on September 5, my wife and I shook hands with Addiscott for the last time. He had been the life and soul of the party during our stay in the town, vivacious and mercurial to a degree, wholly responsive to the brilliancy of the weather and the gaiety of the time. 'Au revoir till Cambridge,' I said, as we parted. 'Au revoir till Cambridge,' he replied gaily. Alas, it is *Au revoir* until the crack of doom!" —Ed.]

Mr. Clancy, from the very outset of his career on the Executive, has done all in his power to bring to light the grave disabilities under which many teachers are working. Whilst agreeing with the "open-door policy" of the present administration, he has protested with his well-known eloquence against the adoption of a similar policy as regards the opening of the profession to the "young man with a degree," or the "Art. 68."

As to the future, we know that Mr. Clancy will adopt the same fearless tactics and the same progressive measures which have characterised his work in the past, and we may rest assured that the status of the teacher, the dignity of the profession, and the prestige of the Union will suffer no loss from being placed in his hands. His election has proved how unsectarian a body the National Union is, and he has great hopes that this will prove effective in inducing many more Catholics to enroll themselves under the Union banner.

We cannot close this brief sketch without a word of praise for Mrs. Clancy, who has done so much to ensure the success of our President-elect. He is the first to acknowledge that his success has been achieved only at the cost of great self-abnegation on the part of his wife. We can only trust that the fact of his elevation to the highest dignity in our Union will compensate in some measure for all her sacrifices.

[At the moment of going to press, we learn with unalloyed satisfaction that the University of Cambridge has resolved to confer the M.A. degree (*honoris causa*) on the subject of our sketch, and on Mr. J. H. Yoxall, M.P., General Secretary of the Union. We mingle our congratulations with those of the 40,000 members of the N.U.T., and rejoice to know that the new dignity will sit gracefully on the shoulders of the worthy recipients.]

☛ **The next paper in the Series of ILLUSTRATED VISITS TO POLYTECHNICS AT HOME AND ABROAD will appear in our April Number.**

# NATIONAL UNION OF TEACHERS.

## ELECTION OF VICE-PRESIDENT.

IT is perhaps a more difficult task than it has ever been before to forecast the result of the election of Vice-President in the coming contest. The candidates are all well-known men, all distinguished for their past services, and all deserving the honour of "the chair." With such men before them, the members of the Union are face to face with a great difficulty and a serious responsibility; but that is the greater reason perhaps why the poll should be a heavy one. We trust, therefore, that every man and woman who receives a voting paper will exercise the franchise, and return the paper, duly signed, within the period named.

Looking back upon the past ten or twelve years, we find that in 1887 Mr. W. J. Pope was elected out of six candidates; in 1888, Mr. R. Wild out of three candidates; in 1889, Mr. H. J. Walker out of five; in 1890, Mr. G. Collins out of four; and in 1891, Mr. J. H. Yoxall out of three. (It is interesting to observe that Mr. Yoxall, the present popular General Secretary of the Union, was a candidate for Vice-Presidency honours in 1889 and again in 1890, standing second on each occasion.) In 1892 Mr. C. Bowden beat Mr. Ernest Gray by 243 votes (this being Mr. Gray's third defeat); in 1893 Mr. Gray was opposed by Mr. T. B. Ellery, who was then making his first appearance in the Vice-Presidency field, and the future member for North West Ham was successful. In 1894 Mr. Ellery was returned unopposed, Messrs. Macnamara, Addiscott, and Clancy retiring in his favour. In 1895 Mr. T. J. Macnamara was one of four candidates, and was elected by an overwhelming majority. A year later the late Mr. C. J. Addiscott was the successful man, the number of candidates on this occasion being four. In 1897 there were only two men in the field, Mr. R. Waddington and Mr. T. Clancy, the former winning by 1,908 votes on a total poll of 22,266. Last year the result was as follows:—Mr. T. Clancy, 15,506 votes; Mr. M. Jackman, 7,796; and Mr. J. C. Horobin, M.A., 5,877. Another strong candidate was Mr. J. F. Blacker, but he retired in order to make Mr. Clancy's return secure.

On the present occasion the candidates are Mr. J. F. Blacker (Brighton), Mr. J. C. Horobin, M.A. (Cambridge), Mr. M. Jackman (London), Mr. Tom John (Wales), and Mr. Frederick Peaker (Leeds), the first and last of these going to the poll for the first time.

The following tables, showing length of service on the Executive, position on poll, and votes received, may be of interest:—

| | | No. on Poll. | Votes. |
|---|---|---|---|
| Mr. T. John ..... | 1887 | 24 | 4,020 |
| | 1888 | 1 | 8,904 |
| | 1889 | 11 | 4,152 |
| | 1890 | 12 | 4,259 |
| | 1891 | 5 | 5,599 |
| | 1892 | 8 | 6,005 |
| | 1893 | 7 | 7,268 |
| | 1894 | 13 | 7,380 |
| | 1895 | 11 | 7,319 |
| | 1896 | 13 | 11,779 |
| | 1897 | 6 | 11,093 |
| Electoral District (Wales) | 1898 | 1 | 1,458 |
| Mr. F. Peaker..... | 1892 | 10 | 5,788 |
| | 1893 | 6 | 7,416 |
| | 1894 | 8 | 8,001 |
| | 1895 | 12 | 7,201 |
| | 1896 | 14 | 8,244 |
| | 1897 | 16 | 8,970 |
| Electoral District (Yorkshire) | 1898 | 1 | 1,779 |

| | | No. on Poll. | Votes. |
|---|---|---|---|
| Mr. J. C. Horobin .. | 1888 | 7 | 6,871 |
| | 1889 | 14 | 3,577 |
| | 1890 | 9 | 4,410 |
| | 1891 | 9 | 4,858 |
| | 1892 | 9 | 5,808 |
| | 1893 | 5 | 7,606 |
| | 1894 | 4 | 8,842 |
| | 1895 | 8 | 7,680 |
| | 1896 | 13 | 8,684 |
| | 1897 | 10 | 9,670 |
| Electoral District (East Anglia) | 1898 | 5 | 708 |
| Mr. M. Jackman ... | 1893 | 21 | 5,125 |
| | 1894 | 10 | 7,829 |
| | 1895 | 2 | 8,627 |
| | 1896 | 5 | 10,293 |
| | 1897 | 7 | 10,820 |
| Electoral District (South London) | 1898 | 2 | 1,563 |

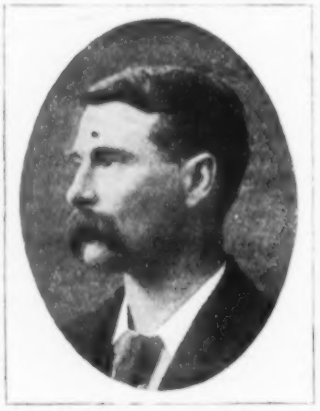
| | | No. on Poll. | Votes. |
|---|---|---|---|
| Mr. J. F. Blacker .. | 1894 | 24 | 5,651 |
| | 1895 | 9 | 7,405 |
| | 1896 | 7 | 9,724 |
| | 1897 | 9 | 9,715 |
| Electoral District (South England) | 1898 | 1 | 1,578 |

Having thus sketched the Executive careers of the candidates, we proceed to give (in alphabetical order) details of past work.

## MR. J. F. BLACKER

is a Cornishman, and was a pupil teacher, first at the Central Schools, Truro, following in the footsteps of genial Richard Greenwood, and then at Holy Trinity Schools, Plymouth, where the late C. J. Addiscott once laboured.

His professional career has been one of marked success. He entered Cheltenham Training College number six on the scholarship list, winning an entrance exhibition. From a letter written by the principal, the Rev. R. M. Chamney, which lies before us, we find the following: "He has been placed in Class 1 in all his examinations," and "he gave the best lesson before Her Majesty's Inspector." Mr. John Gill—a name dear to all old Chelts—said of Mr. Blacker in November 1875, "He has shown himself a very diligent, conscientious, and intelligent student;" and again, "I regard him as a young man of great promise."



MR. J. F. BLACKER.

After two years' training, he was appointed head-master of Christ Church Schools, Brighton, beginning his duties there in January 1876, and joining the Union about two years later. His record as a practical teacher has been one of unbroken success. (See THE PRACTICAL TEACHER for February 1898.)

When Conference first went to Brighton, in 1880, the onerous work of Secretary to the Reception Committee fell to his share, and many members of the Union felt and expressed their gratitude to him for his labours in that direction. The 1896 Conference at Brighton found him President of the Local Association and Chairman of the Conference Committee. None but his immediate friends can ever know what anxiety and what work fell to him in connection with that event. Brighton excelled itself, and those who were privileged to witness all the functions, and to hear the gracious and eloquent speech of the Duke of York, in reply to the equally touching addresses of Mrs. Burgwin and Mr. Yoxall, must have been deeply moved. What the Brighton teachers thought of Mr. Blacker's services is best expressed by an illuminated address which they presented to him "as a slight memento of his two years of office as Vice-President and President, which included the successful and brilliant Brighton Conference." The address goes on to say that the success of the Conference "was largely due to his energy, unceasing labours, watchful care, and forethought."

The same sterling qualities are shown by Mr. Blacker in his work for the Union as a member of the Executive. As a leader in the solution of the tenure problem he will ever be associated with the Baseden case, which revolutionised the policy of the Brighton and other School Boards. Other victories were also due in a high degree to his generalship. Southwick returned a party of three members (out of five) pledged to fair play, thus defeating a dangerous rural School Board policy. Plymouth, too, and Brighton for the second time, vindicated the teacher's position; and in both cases Mr. Blacker played a prominent part. Nor is this all. Much time, anxious thought, and careful work on his part have resulted in the safety of the teacher *without publicity*. In Mr. Blacker's opinion, now that the principle of Superannuation has been recognised, Reasonable Security of Tenure and Sustentation are *the* professional questions of the day. For five years he has had a seat upon the Executive of the N.U.T., and has stuck to his work with a zeal and firmness of purpose deserving the highest praise. Sitting through the committee meetings, never absent from his duties except when disabled by illness, he claims that he has fulfilled absolutely, to the best of his powers, the highest traditions of the body to which he is proud to belong.

Some months ago his colleagues did him the honour of electing him to the Chairmanship of the Parliamentary Committee, in which capacity we are confident he will discharge his duties to the complete satisfaction of every member of the Union.

## MR. J. C. HOROBIN, M.A.,

is the able Principal of the New Homerton Training College. For many years he has devoted himself to Union work, and his experience has been of the most varied character. He has laboured in rural schools and in town schools (including the factory mixed half-time school); he has served the London School Board in the capacity of class teacher; and he is now, as we have said, the principal of a training college. In 1887 he prepared a valuable paper on "The Supply of Teachers," for which he received the thanks of the Executive of the N.U.T. The following year saw him a member of that body, a position he held without a break until 1898. During all these years he rendered excellent service in many directions, especially in connection with the Education and Law Committees, and with the question of Superannuation.

Putting his Union career briefly, we may observe that he has been a member of the N.U.T. for twenty-two years, ten of which have been spent at the Executive Board; for seven years he was on the Council of the Funds; and for seven years he was in office either of the Law or the Education Committee. He is now the Secretary for the Press, Charities, and Art Exhibition Committees of the Cambridge Conference Committee, 1899. Nor does this complete his "record;" for he was twice successful in obtaining a seat upon the London School Board, where he made his influence and ability felt. The revised Corporal Punishment regulations, the relief granted to experienced teachers in the matter of Drill and Kindergarten Certificates, and the rule forbidding inquiries, directly and indirectly, into the theological opinions or the belief of candidates for the Board's service, were in no small degree due to his labours as a member of that Board.

Turning again to executive work, we may point out that Mr. Horobin is justified in claiming that he has been closely and actively connected with Parliamentary Representation, Abolition of Payment by Results, Organisation and Development of the Law Work, Origination of the Tenure Committee, Superannuation, Welsh Intermediate Schools Act, Simplification of Schedule III., and the fight for Security of Tenure. It will be remembered that he took an active and valuable part in the Wimblington, Aycliffe, and Southampton cases.

MR. J. C. HOROBIN, M.A.

His educational "platform" includes the following:—(1.) A more vigorous policy against (*a*) the admission of the unqualified and partially-qualified practitioner, (*b*) the combination of school departments, (*c*) the supplanting of men by women at lower rates of pay, and (*d*) the differential salaries of men and women, and mistresses of girls' and infants' schools, if the present low average of remuneration is to be raised. (2.) The formation of a strong Union Sustentation Fund. (3.) A definite agitation in favour of a professional rather than a departmental status, in view of the changes imminent in the organisation of secondary education. (4.) For every school the income necessary to secure efficiency and the proper remuneration of the teachers. (5.) In internal affairs, the extension of local and parliamentary effort, and such a rearrangement of finances as will secure for every member, by one subscription, all the benefits the Union can offer.

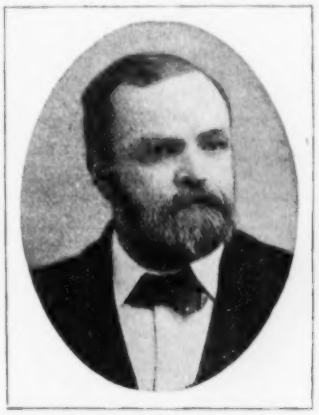
## MR. MARSHALL JACKMAN

was a pupil teacher in an Exeter school, was trained at Borough Road in the years 1879–80, and since that time has been in the service of the London School Board—fifteen years as class teacher and three years as head-master. For seventeen years he has been a member of the Southwark Association. He was first elected to the Executive at the Liverpool Conference in 1893, and almost at once he aimed at "taking a front seat." The Executive and the Union were not progressive enough for a man of his advanced views; the finances of the Union were not, in his opinion, on the right basis; and the organisation of the country for membership purposes was sadly imperfect. Accordingly Mr. Jackman set to work, and in a very short space of time brought about some of the "reforms" upon which he had set his heart. He is best known as a fighting man, his qualities in this respect having been first displayed in the Wimblington tenure case. Since that time his policy has been of the most "forward" and "aggressive" character. The writer once heard him say, with reference to certain individuals upon whom he was bestowing somewhat close attention, "I'll make 'em sit up," and "sit up" they did. Others, too, have been compelled at various times to adopt a similar attitude in response to the bidding of this (so-called) "firebrand." There can be no question that Mr. Jackman, much as many members of the Union may differ from him, has rendered good service by his absolute fearlessness and unfailing resolution and resource. In debate he is clear, ready, and shrewd; and he never knows when he is beaten, as several presidents of the Union have found to their cost. (We are bound to say, however, in justice to "the chair," that Mr. Jackman has never "scored" in these encounters.) In his second year at Russell Square he was elected Vice-Chairman of the Parliamentary Committee, and in his third year he became Chairman of the Organisation Committee in succession to Mr. Tom John. When the principle of Electoral Districts was approved by Conference, and the Executive set to work to devise a good and workable scheme, Mr. Jackman again came to the rescue, and rendered most efficient service. Indeed, it would be difficult to name any department of Executive work in which his assistance has not been given and welcomed. The class teachers have always found in him a champion upon whom they could rely, and that they have been thoroughly satisfied with the results of his efforts is seen from the resolutions passed by them in their annual conferences, and from the reception accorded to him whenever he attends their meetings. He has held the office of President of the M.B.T.A., the highest honour the London Board teachers can bestow upon one of their number; he fought for the new Corporal Punishment regulations; he led the opposition to what he considered the unfair Superannuation Scheme for London Teachers; and he was one of the most strenuous opponents of the notorious "Religious" Circular of 1894. With his pen, too, he has rendered a distinct service not only to teachers in particular, but also to the cause of education generally. Among the many articles and pamphlets written by him we may name *Education and Crime*, *Pension Tables*, *Pedagogue and Policeman*, all of which have been extremely useful. Nor must we forget his *Educational Facts and Figures*, his *Large Classes Statistics*, his *School Board for London Expenditure* articles, his *Superannuation in the Seventies*, and his *Comparative Tables of Salaries*. The editor of *The Schoolmaster*, in which these articles appeared, paid the writer a well-deserved compliment when he referred to Mr. Jackman's "strictly impartial attitude," and "extraordinary aptitude in handling large masses of figures." In conclusion, we would add that Mr. Jackman states his policy as follows: "The Child before the System. Education before the Denomination. The Teacher before the Manager. Teaching a Profession."

MR. MARSHALL JACKMAN.

## MR. TOM JOHN

is a native of Aberdare, and is at present the head-master of the Llwynypia Board School, Rhondda Valley—one of the largest and best-equipped schools in South Wales. His name is well known to the teaching profession in England, for he has a record of eleven years' active service on the Executive of the N.U.T.; but in Wales he is known to all classes as the schoolmaster patriot who has ungrudgingly devoted his best energies and ability to the promotion of the highest and best interests of his country. The "Young Wales" party has known no more active and conscientious worker than he. In the initial stages of the agitation for the passing of the Welsh Intermediate Act and the establishment of a Welsh university Mr. John laboured assiduously, and later on was favoured with a seat on the Court of Governors of the University and the Central Board of Intermediate Education. Last year an additional compliment was paid to him in his election to the executive of the latter body—a position in which he has been able to render incalculable service by watching carefully over the interests of primary education, inasmuch as even in Wales there have not been wanting signs in high places of a tendency to draw a distinctive line of demarcation between primary and secondary education. In spite of his multifarious public duties and the charge of a large school, Mr. John—the "Prince *in* Wales," as he has been termed—has for years been able to discharge efficiently the important and onerous duties of editor of *The Glamorgan Free Press*, a weekly paper with a very large circulation in the colliery districts of South Wales. He has also been selected to serve on the executive dealing with the Welsh educational exhibits in connection with the Paris Exhibition of 1900.



MR. TOM JOHN.

In his native country Mr. John is recognised as one of the most popular conductors of Eisteddfodau—national gatherings where oftentimes thousands congregate to hear competitions in musical and literary subjects; and here his illimitable fund of humour, smart repartee, and intimate knowledge of his countrymen's characteristics, have always enabled him to control these large audiences with the greatest ease.

For eleven years he has been the "member for Wales" on the N.U.T. Executive, and during that time he has been Chairman of the Organisation Committee for three years, and Vice-Chairman of the Parliamentary Committee for a similar period.

When he first joined the Executive, Unionism in Wales was not so popular as it is to-day. The membership then was only 500. Mainly through his efforts in visiting the rural districts of Wales, and in unceasingly preaching the gospel of Unionism, the membership has risen to nearly 3,000. He has always been a stanch supporter of the Charities, and is a Vice-Patron of both the Orphan and Benevolent Funds. To this we may add that he was solely responsible for the movement which secured the magnificent sum of £1,800 for the Cardiff Conference.

It is betraying no secret when we say that some years ago Mr. John was approached with a view to becoming a

candidate for Parliamentary honours, the constituency being, of course, a Welsh one. Inquiries were made as to the possibilities of success, and the present writer having been on the spot at the time, he can answer for it that Mr. John's name was splendidly received everywhere. Circumstances occurred, however, which rendered it undesirable for him to continue the negotiations at that time. Still, if Wales knows its duty, the "Prince" will find his way into Parliament at no distant date.

### MR. FREDERICK PEAKER

is perhaps the only candidate who can devote the whole of his time to the interests of the profession. He was trained at York in the years 1885–86, and, of course, was placed in the first division each year. For some years he was a class teacher in the service of the Leeds School Board; he has been a member of the Executive of the N.U.T. eight years; for twelve years he has had a seat on the committee of the Leeds local branch; and he is now the Secretary of the Leeds N.U.T. and of the Leeds Board Teachers' Associations. He gave up his appointment as class teacher on his election to the Leeds School Board, as a member of which he rendered excellent service to the teachers who had made it possible for him to hold that position. Unfortunately, at the last election he was one of the unsuccessful candidates—a result due to over-confidence on the part of his friends and supporters. Let us hope that the affair will be better managed on the next occasion. Mr. Peaker has a thorough grip of all Union questions, for he has spared no pains in his endeavour to master details. He is strong in debate, and a sturdy fighter. On the resignation by Mr. Ellery of the Chairmanship of the Finance, Press, and General Purposes Committee, Mr. Peaker was unanimously elected to the vacant post. It is not too much to say that he has entered thoroughly into his work in that capacity, and realised to the full all that was expected of him. His Chairmanship from first to last has been a complete success.

MR. FREDERICK PEAKER.

As Vice-Chairman, too, of the Technical and Secondary Education Committee, and in his inquiries as a member of the Law Committee, his services have been exceedingly valuable, especially, perhaps, in the latter direction, inasmuch as his freedom from school cares rendered it possible for him to undertake work of the most important character, often at a moment's notice. Having youth on his side, he has been able to face long railway journeys without a murmur, and apparently without serious consequences. In one year he travelled 15,000 miles in the service of the Union, and in all probability his record for 1898 exceeded even that large total.

That he is held in high respect by his Yorkshire friends is well known to all who follow Union matters closely—"One who has done such yeoman work for the Union, and who must represent Yorkshire on the Executive," said the 1898 President of the West Yorkshire District Union.

The Leeds infants' school teachers also have shown their appreciation of his services in the following resolution: "We desire to record our appreciation of the efforts made by Mr. Peaker to ameliorate the conditions of work at present obtaining in infants' schools, and to obtain for teachers freedom to teach as the exigencies of the particular school may require."

And what his Yorkshire friends say of him is said by his colleagues on the Executive. He is unquestionably a young man of great ability and sound judgment, and one who has deserved well at the hands of his fellow Unionists.

## THE PEACE CRUSADE.

THERE are at present in progress several notable efforts on behalf of a more enlightened and more Christian civilisation. One of these is a movement, which has such vast possibilities that it commands the attention, and deserves the help, of the wise, the thoughtful, and the influential minds of all nations. This is the *War Against War* which has been undertaken with such determination and such enthusiasm by the lovers of peace, with Mr. Stead for their captain.

After the issue last August of the Tsar's Rescript in favour of a conference to consider proposals for an arrest of armaments in the nations of Europe, Mr. Stead made a pilgrimage of inquiry to the various European capitals. At the end of the year he came home glowing with hope for the cause of peace, and threw himself heart and soul into a scheme for rousing the people of this country to energetic action in support of the Tsar's proposals. He has enlisted a numerous body of influential helpers—peers and commoners, prelates of the church, and the shining lights of nonconformity, men of letters, and popular leaders. Through an active committee he is organising a series of meetings of citizens in all parts of the kingdom. He has started a penny weekly journal as the organ of this crusade, and already five numbers have appeared. Each is full of interesting reading, contributed by eminent men, with a chronicle of the campaign, vividly written by the editor.

Mr. Stead has that power of personal magnetism which enables him to *enthuse* others with the earnestness with which he himself overflows. Just now he is so busy with a constant succession of engagements that he hardly finds time for eating and sleeping. We have, however, received from a correspondent some notes of a brief interview with Mr. Stead while he was snatching a meal in the midst of hurried preparations for a journey to a meeting.

"Are you satisfied with the result so far of the various towns' meetings that have been held?"

"Quite. Not only has an opportunity been given for explanation of the crusade, and volunteers enrolled in large numbers, but arrangements have generally been made for holding local meetings in the districts round."

"Then you think people are beginning to understand the object of the peace crusade?"

"Yes; where meetings have been held it is realised that we have no such impossible idea as that war can be altogether done away with, or that Great Britain is to disband her soldiers, underman her fleet, and generally place herself at the mercy of any foe ready to attack her. At the Leeds meeting, indeed, a Tolstoyite tried to move an amendment condemning the movement because it was too warlike."

"Do you think any common international agreement for arrest of armaments can be made?"

"If our statesmen and those of other nations are awake to the opportunity, much more than this may be done at the conference; so the friends of peace in France, Germany, and other countries are vigorously working to second our efforts. Scotland is going to have a National Conference at Edinburgh in March, after which the other Scottish towns will act. In Wales there have been meetings at Cardiff and Colwyn Bay."

"Do you arrange the meetings yourself?"

"Oh dear, no! I am in the hands of a committee. They fix me up for a fortnight in advance, and I go where I am told. Those who want me must write to Mr. Corrie Grant, 9 Arundel Street, Strand, London."

"One more question, Mr. Stead, and an important one for teachers," says our interviewer. "It has been said that too much stress is laid upon the heroism of the soldier and the sailor, and that we make too much fuss over the deeds of such men as Blake and Nelson, Wellington and Gordon. I myself could not do other than tell my pupils of their noble endurance, bravery, and patriotism. Now what do you say?"

"Why, of course you must! Don't you know that I always on peace platforms hold up Tommy Atkins as the best exemplar for the volunteers in the service of peace? But war is becoming more and more an affair, not of personal heroism and chivalry, but of machine-made slaughter."

Mr. Stead's hasty meal was finished, but he remarked, as the interviewer said good-bye, "Do not forget our motto: 'Always arbitrate before you fight.'"

We are pleased to see that our good friend, M. Mieille, is wielding his pen in the same good cause. We find an effective article by him, on "France et Angleterre," in *L'Arbitrage entre Nations* for January; and others, on "Le Désarmement en France" and "L'Arbitrage International," in the daily journal *Les Pyrénées*. These are in perfect concord with the spirit and purpose of his admirable system of international correspondence.

# THE EDUCATIONAL WORLD

A REVIEW OF EDUCATIONAL TOPICS AT HOME AND ABROAD.

## EDUCATION IN ENGLAND.

### N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

*President of the National Union of Teachers, 1895-96.*

**The National Society's Committee and Pupil Teachers.**

THE Report of the Departmental Committee on the Pupil-Teacher System was no sooner in the hands of the public than the National Society and its friends began to think seriously of calling together a body of churchmen, in order to see what justification there was, if any, for the findings of that Departmental Committee. I am afraid the solution of the problem has not been in any way helped forward by the labours of the Archbishop of Canterbury and those who assisted him. It really seems as if the real difficulties were avoided by these good people, and as if several at least of the witnesses called before the committee were not in a position to give material help. These were the points under consideration in the matter of the difficulty in obtaining pupil teachers—(1) bad pay, (2) distaste of teaching, (3) expense of training, (4) hard work, (5) insecurity of tenure, (6) extraneous duties, and (7) the denominational difficulty. With a few notable exceptions, the witnesses agreed that (5), (6), and (7) had no bearing whatever on the question. Prebendary Hodson of Enfield indeed said, "Nobody ever dreams of making a grievance of these when he becomes a pupil teacher." And this from the man who knew as much as most people of the notorious Ponder's End case! Dr. Macnamara very properly emphasises this point in his leader of February 4. Then, again, the good Sisters at Wantage declare that "insecurity of tenure is wholly fallacious. Extraneous duties are purely voluntary." On the other hand, Dr. Waller of the Westminster Training College gave it as his opinion that "insecurity of tenure may have been a deterrent in the past." Mr. William Padwick, Master of Method, Winchester, admitted too that there have been cases of great injustice in two or three Church schools and also in Board schools, and he thought there should be a right of appeal to the Department.

**Mr. G. W. Stone of the Salford Board P.T. Centre.**

But the gentleman who deserves the distinction of a separate note is Mr. G. W. Stone, who, in reply to a question by the Dean of St. Paul's, made the following extraordinary statement:—

"I do not think that the teacher's tenure is less secure than that of any other man; I think that it is rather more secure. *I never knew a teacher yet who was doing honest work who did not keep his place.*"

Where, in the name of fortune, has Mr. G. W. Stone lived of late? Has he never heard of the Wimblington case, the Ponder's End case, the Tillington case, the Aycliffe case, and the Linthwaite case—to mention but a few? If he has, then he did not tell the committee all he knew. If he has not, it is clear that he knows little of the question, and he should have frankly said so.

**Dr. Macnamara gives "Striking Evidence" and makes "Ingenious Suggestions."**

The editor of *The Schoolmaster* was a witness of a very different character. Like Mr. Stone, he did not hesitate to give his opinions, but there was this difference—Dr. Macnamara was in a position to speak, for he has closely studied the question in all its bearings. The Archbishop, the Rev. H. Martin, the Dean of St. Paul's, Prebendary Reynolds, and others, endeavoured to convince him that he was wrong; but to no purpose. He stuck to his Blue Book in the matter of salaries, and to his own personal knowledge—gained by "inquiries on the spot" in all parts of the country—in the matter of insecurity of tenure, with a firmness which nothing could shake. The doctor urged that pupil teachers should not be counted on the staff at all, and he would have the Government provide for the large additional cost which would be thus incurred. This was one of his "ingenious suggestions" (in the words of the report) which the committee did not see its way to accept.

**A Teacher's Opinion.**

Mr. C. W. Drew of Martock National School sent his opinion in writing (as did the Wantage Sisters, Dr. Waller, and others). He gave it as his firm conviction that the bad pay and hard work during pupil-teachership accounted for much of the difficulty in obtaining suitable candidates. He pointed out—(1) that many Board school pupil teachers start at £20, rising to £40 for the fourth year; and (2) that the railway boy-clerk makes a beginning with £15 and rises to £60. This is sufficiently telling, of course, but the most remarkable statement he made was as follows:—**"Insecurity of tenure is the greatest bane in the scholastic profession."** What do Prebendary Hodson and Mr. G. W. Stone say to that?

**The Conclusion of the Whole Matter.**

I have dealt with but a few points in this report, but I have said all that is necessary, perhaps, to show that some at least of the conclusions arrived at are based upon evidence that was inaccurate in some cases and insufficient in others. The committee would have done well to have gone further afield. "The other causes alleged for the deficiency in the supply of pupil teachers do not appear to us to be borne out by any clear evidence." Exactly as most of us expected. But I wonder what the officials at Russell Square have to say in answer to this verdict of "Not proved"? I venture to say that if the Archbishop would spend a few days in the Union's Law Offices he would at once issue on his own authority a supplementary report to the effect that there appeared to be some evidence after all.

**The Little Factory Slave.**

There is every reason to believe that a step forward will be taken this session in the matter of raising the age at which children may leave school. The N.U.T. is in earnest, and that means success sooner or later. All of us would like Mr. Waddington to see the fruits of his labour before he gives up the chair to his successor. But though that cannot be, yet the hour of victory cannot be far distant, and every teacher in the land will then congratulate the champion of "The Little Factory Slave." A well-known Church paper has the following in its issue of February 3:—

"There is some satisfaction in knowing that what is called the half-time system is dying out. The system has been adopted chiefly in the manufacturing districts of Lancashire and Yorkshire; but the operatives themselves seem to have come to the conclusion that it does not pay—that any small payment they receive for the child's labour is more than neutralised by loss of health. During the last six years the number so employed in Yorkshire has decreased about one-half, and in Lancashire nearly two-thirds. A more healthy opinion is evidently gaining ground, and we may anticipate that before long no children of school age will have to spend half their day in the close, unhealthy confinement of a cotton or woollen manufactory."

**The Educational Systems of Germany, Switzerland, and France.** I see in a London newspaper that the demand for improved methods of education has found expression in the offer to the London School Board, by an anonymous donor, of a cheque for £120, the condition governing the offer being that one of the Board's teachers shall proceed to Germany, Switzerland, and France to examine the teaching systems practised in the elementary schools of these countries. The School Board, the journal goes on to say, is prepared to grant leave of absence to the teacher chosen, from September next to July 1900, but without pay. The teacher is to cover all expenses with the cheque, and on returning will be appointed to one of the Board's schools, in order that the foreign systems may be brought to the test of experiment. I am fully persuaded that in the near future much will be done in this direction. Shout as we will as to the supremacy of "England, bonny England," we shall as a nation realise one day that we have something to learn, and that we must pay for it.

**Visits of School Children to Technical Schools.** The Technical Education Board of the London County Council rightly considers that much can be done to interest school children in the various mechanical trades and artistic crafts of the present day by arranging for visits to be paid to educational institutions where instruction in such trades and crafts is given. As the photo-process trade appears to adapt itself very well for this purpose—the different processes involved in the trade being of considerable interest and variety, and lending themselves readily to practical demonstrations—it is proposed to offer opportunities at the Bolt Court Technical School, 6 Fleet Street, E.C., for demonstrations to be given to selected children from public elementary schools, with the view of interesting them in the photo-process and kindred industries.

Board and Voluntary schools alike may avail themselves of the privilege—the only stipulations being that only the older children can be admitted; that not more than six pupils can visit the school at any one time, on account of restricted accommodation; that a teacher must be in charge, and be responsible for good conduct; and that application must be made to the secretary of the Board by the head-master. At the first visit the demonstration will take the form of negative-making; at the second, preparation of resist for line and half-tone etching, and specimen of half-tone etching; and at the third, etching of plate prepared on previous visit. If a fourth visit be arranged, then the subject of preparation of lithographic transfer would be dealt with.

I should say that London teachers will gladly avail themselves of the offer. Whether the limitation as to "six pupils" applies to one school only, or to the total number to be admitted at one time, I am not quite clear.

**The Coming Conference.** As I said in my notes in the last issue, we are to have a busy and interesting week at Easter. There are to be several "At Homes," the one on Monday being at Newnham College. This will be, I understand, quite a delightful feature in the week's proceedings, gentlemen as well as ladies being invited. From what I have seen, indeed, of the suggested programme for the week, the Cambridge local committee has succeeded admirably. But I reserve full particulars for THE PRACTICAL TEACHER'S Easter number.

**Another New Departure.** The work of the Examination Board of the N.U.T. has developed to such an extent that the Executive has come to the conclusion that this department must be placed in charge of a special officer, who shall give his whole time to the work. Conference will, therefore, be asked to agree to this "new departure," and also to the appointment of Mr. A. A. Thomas, B.A., to the office, at a commencing salary of £250. Mr. Thomas has rendered excellent service as honorary secretary, and I am confident no better appointment could be made. The Conference will do well to give the proposal very serious consideration.

☞ **Many new and beautiful Object Lesson Supplements are now in preparation for presentation with the numbers of this Journal to be issued during the present year.**

# EDUCATION IN SCOTLAND.

## E.I.S. NOTES, ETC.

BY JAMES PATERSON,

*Ex-Vice-President of the Educational Institute of Scotland.*

**Our National Education.** At a meeting of the Edinburgh Association of Science and Art held recently, Mr. James Oliphant, M.A., read a paper on "Our National Education." Dealing with the Education Codes, Mr. Oliphant held that too much time was devoted to such subjects as spelling, arithmetic, grammar, history, and geography, and too little to the sciences of experiment and observation, and such arts as singing, drawing, recitation, and composition. What he conceived as the primary object of our elementary education was so to interest the children that when they left school they might have an inclination to carry on culture for themselves; and as things were at present, it could not be doubted that knowledge was imparted in such a way that the children were glad to throw off study at the earliest opportunity.

**Admission to Training Colleges.** The authorities of the training colleges have determined that, in admitting candidates in future, the list of first-class applicants, wherever examined, shall be exhausted before second-class candidates are received. This arrangement will be inter-collegiate—that is to say, none of the colleges will admit a candidate of the second class while any of the first class remain unprovided for.

**Scottish Educational Exhibits for the Paris Exhibition.** A conference convened by the Earl of Hopetoun, as representative for Scottish education on the Education Subcommittee of the Royal Commission for the Paris Exhibition of 1900, was held in Edinburgh lately, and was attended by leading educationists from all parts of Scotland. A motion that Scottish education in all its grades and branches should be adequately represented at the Exhibition was adopted, together with a resolution pledging all the representatives present to endeavour to carry out this object. Committees were appointed for the various classes of schools, the President of the Educational Institute being appointed a member of the Committee on Board School Education. It is intended that the exhibits shall be exposed to view in Edinburgh, about Christmas time, before being sent on to Paris.

**Edinburgh Branch, E.I.S.** At a recent meeting of the Edinburgh Branch of the E.I.S., Dr. Morgan, of the E.C. Training College, delivered an address on "The Training of Primary and Secondary Teachers in Germany." One of our weaknesses, he said, was our self-sufficiency and our indifference to what other people were doing. In the race of nations, we could no more afford to ignore the educational progress of other countries than we could afford to ignore their progress in armaments and industrial pursuits. The main principles of educational methods ought to coincide in all countries, as they had to deal with the same mental faculties, and had the same end in view—the moral and intellectual well-being of the people. Dr. Morgan proceeded to give some details of the German system, showing how, in many instances, Britain suffered by comparison. Training colleges were established in Germany a hundred years before they were adopted in this country. Germany was not so much in front of us in the quality of the work done as in the number of fully-equipped schools at which the scholars remained until they were eighteen or nineteen years of age. There were no pupil teachers in Germany, the system being considered wrong, and unfair to all parties concerned.

**Glasgow Branch, E.I.S.** At the January meeting of the Glasgow Branch of the Institute, papers were read by Miss Hamilton, L.L.A., Pupil Teachers' Institute, on "Pupil Teachers," and by Miss White, Clydebank School, on "Infants' Rooms of School Buildings." Three qualifications, Miss Hamilton said, were necessary for a pupil teacher—namely, a good general education, professional training, and an expert knowledge of some sort of school work. A pupil teacher ought to be trained directly under the charge of the

head-master, and in that training she ought to be allowed to assist in mechanical work, to observe the lessons given in each subject of the school curriculum, and to give lessons under the supervision of the head-master in each subject required by each class. Miss Hamilton concluded by moving that, "considering the standard of scholarship demanded of candidates for the teaching profession, the apprenticeship of pupil teachers should be limited to two years, and their value in calculating the school staff reduced, and the number of apprentices made to approximate more closely to the number admitted to the training colleges."—Miss White condemned many of the rooms in infants' departments as too large, and maintained that the most satisfactory tuition could be given only when each teacher had a separate classroom, as in the case of the standard classes.

**Military Training in Board Schools.** General Chapman, the Officer Commanding in Scotland, who is trying to interest School Boards in the more systematic teaching of physical training in schools, has issued the following order:—"Officers commanding regimental districts will communicate with chairmen of School Boards within the area of their commands, and will ascertain whether it may be possible for them to render any assistance to schools, either by sending trained men who may instruct the scholars in physical exercises and drill, or by receiving at the depôts such instructors as have been soldiers, and affording them opportunity of learning what has been recently taught in military gymnasia. School teachers who may be similarly in need of instruction may, as far as possible, be assisted, if recommended by the chairmen of School Boards, under arrangements to be made by the officers commanding regimental districts. Sergeant-instructors of the permanent staff who are allowed to undertake the duty of teaching in schools should be called in to regimental district headquarters, to go through a course, or to prove their efficiency."

**Labour and Merit Certificates.** The abolition of the examination in the Fifth Standard in connection with H.M. Inspector's visit to a school, and the substitution therefor of a central examination for Labour Certificates, has already proved successful in checking the wholesale exodus of pupils after passing the Fifth Standard, and, taken along with the Merit Certificate, is likely to lead to a largely-increased proportion of pupils remaining till at least the end of the Sixth Standard. In reference to the requirements for the Merit Certificate, even more definite instructions than those already issued to H.M. Inspectors would seem necessary. In at least one inspectorial district, pupils who had passed the Lower Grade Leaving Certificate Examination in English and arithmetic, and were well on their way towards the Higher Grade, have been plucked right and left; while in many districts the requirements are simply those of the Sixth Standard. The standard of examination should certainly be uniform for all parts of the country. How would it do to have a Lower Grade Merit Certificate for the work of Standard VI., and a Higher Grade Certificate for those pupils who remained a year beyond the Sixth Standard?

**Spartans in Edinburgh.** At the February meeting of the Edinburgh Branch of the E.I.S., Mr. J. Edward Parrott, M.A., LL.B., contributed a highly-appreciated paper on "Spartan Education." After passing in review the main features of the semi-military, semi-monastic *régime* established by Lycurgus, he pointed out that the result was to make lop-sided men, splendidly null, because bodily development and moral discipline alone were insisted upon. The chief lesson of the Spartan system was that the development of a sound body in every citizen should be absolutely the first care of a right secular education. The physical exercises insisted upon by our Code were not sufficient, and yet the time table was chock-full. Something must go—the dreary terminology of grammar and the painful dissection of literary curiosities, for example. As a panacea for the tendencies towards physical degeneration, compulsory military drill was suggested. It was not the concern of national education, however, to make soldiers, but to make men. The playing field, he thought, was the best of all gymnasia, and a fine school of practical morality to boot. The usual acknowledgment was cordially made, on the motion of Dr. Gunn.

## NOTES FROM THE NORTH.

**Scottish Assistant Teachers' Congress.** During the seven years of its existence the Scottish Assistant Teachers' Association has held two congresses, the first one taking place at Dundee in 1897. Edinburgh is chosen as the place of meeting this year, largely because of the fact that both the President and the Vice-President of the Association belong to that district. The Royal High School—the scene of the September meetings of the E.I.S.—is selected for the occasion, and it is not too well filled when the President (Mr. Robert G. Dickson, M.A., Edinburgh) enters, accompanied by Sir James Russell, who takes the place of the Lord Provost of the city in his unavoidable absence; Mr. Colin G. Macrae, Chairman of the Edinburgh School Board; Mr. Robert Miller, Chairman of the Leith School Board; Mr. A. E. Scougal, Mr. Robert Blair, and Mr. Wattie, H.M.I.S.; Mr. J. G. Thomson, Paisley, President of E.I.S.; Dr. Mackay, Treasurer of E.I.S., and others well known in educational gatherings in Scotland. Owing to the defective heating of the hall, and the intense coldness of the day, much inconvenience is experienced by those present.

**President's Address.** The welcome by the civic and educational authorities of the city—whose industry is education—being accorded, the Congress, now increased in numbers, is addressed by the President. He points out that the year just closed has been marked by great and far-reaching changes, both professional and educational. A year that has witnessed the passing of an Act affirming the principle of superannuation for elementary teachers stands out pre-eminent. The Scotch Education Department, too, has made strenuous efforts to preach the gospel of freedom, and he hopes to see the spirit breathed in the Circulars and Minutes carried further, so that among the reforms of 1899 will be the introduction of a fixed capitation grant. This grant, he thinks, would remove the objectionable custom of instituting comparisons between schools in regard to the average grant earned per pupil.

The efficiency of teachers and the size of classes form the two chief points of his address. With regard to the first, he points out that the age of large schools has revolutionised the profession. At no time more than the present was the teacher more the moulder of the youth of his country. Since his duties are so important, and since the attainments demanded of him are so high, it is essential that his training be of the highest order; and it is incumbent on the nation to see that no one is admitted to the profession who is not duly trained and educated.

To enter the profession there seems to be no limit to the number of portals. There might be some excuse for this state of matters in 1872, in view of the newly-created demand for teachers of any kind and the inadequateness of the supply; but no justification could be found for it now. The number of boy pupil teachers, too, is decreasing. In the stereotyped clause of the Education Blue Books, waste in the profession is calculated at 6 per cent.—and the Government acknowledges that to be low—yet last year there were admitted into the profession 126, including acting teachers. The number of male certificated teachers in Scotland is 4,221, and 6 per cent. of this would equal 253; so that less than half the number required is admitted.

With regard to size of classes, he maintains that to develop intelligence, to train and fit pupils for the contest with foreign rivals, is an impossibility in classes such as exist in many schools. He gives statistics to show what other countries are doing in this matter, and he calls on the Association to try to lessen the evil by speaking out in season and out of season, and by not sitting idle and allowing those who know very little about the matter to continue this unsatisfactory state of things.

If we are to maintain our position as the foremost nation in the world in commerce and manufactures; if we are to train and equip men and women to compete with other nations in all pursuits of knowledge; if we are to make good citizens—citizens who will take their share in the government of our country, a government which every year is demanding increased intelligence and wider knowledge—it

behoves us, he says, to see that the children of the present day get sufficient, if not ample, opportunities of laying a solid and serviceable foundation. And to this end he appeals for a full and generous recognition of the great difficulties under which education is at present conducted, and for a determined and whole-hearted endeavour, from all who have any part in its advancement, to remove these obstacles to further progress.

On the motion of Mr. James Paterson, South Bridge School, Edinburgh, one of the candidates for the presidentship of the Institute, we accord Mr. Dickson a hearty vote of thanks for his able and eloquent address.

**The Mutual Relation of Primary and Secondary Education.** Mr. John G. Thomson, Paisley, President of the E.I.S., next addresses the Congress on "The Mutual Relation of Primary and Secondary Education." In 1872 primary education evidently meant that amount without which no child should be allowed to grow up, like a barbarous weed in a garden of civilisation; it was that which was essential for the nation as a whole, even for the lowest stratum of society. Secondary education, on the other hand, was that which was equally necessary for the foreman, overseer, and manager—the leaders in the national organisation. He then alludes to the schools of the Germans, and points out their superiority in many respects. He concludes by saying that we are anxiously awaiting the stimulus that is sure to come through the issue by the E.I.S. of the researches of the Commission on Higher Education. These will greatly help us in showing what to do and how to do it, so that our Scottish education, acknowledged to be the best that is, or has ever been, in the world in its primary stems, will also become the completest and most flourishing in all secondary branches.

Miss Flora C. Stevenson, member of the Edinburgh School Board, moves a very cordial vote of thanks to Mr. Thomson for his poetic yet practical paper.

The temperature of the hall not having improved, an adjournment is made to one of the class-rooms of the school, which has been heated. In these more comfortable surroundings, on the motion of Mr. Charles M'Donald, M.A., Vice-President, we agree to the following resolution:—"That this Congress of class teachers is of opinion that, to attain the maximum of efficiency, the national system of education should be continuous from the primary school upwards; and views with regret the attempts at present being made to draw an arbitrary line of demarcation between primary and secondary education."

**An English Delegate.** The President then introduces Mr. Allen Croft, Nottingham, ex-President of the N.F.A.T., who, in a felicitous address, conveys the cordial greetings of his association to the Scottish teachers. He thinks the N.U.T. would have been delighted to send a representative—a sentiment which is much applauded. The omissions from the agenda paper, he says, have struck him much, particularly the fact that there is no reference to the question of salaries. He thinks that Lord Balfour of Burleigh, who recently penned some remarkable words with regard to assistant teachers, does not understand what an assistant teacher is. He seems, in Mr. Croft's opinion, to be in the position of the man in the street who thinks an assistant teacher is a telescopic pupil teacher indefinitely elongated. It being now impossible for at least 80 per cent. of the class masters to be anything but assistants, he asks the public to accord them adequate remuneration to meet this new state of matters. The President asks Mr. Croft to carry back with him the good wishes and friendly greetings of the S.A.T.A., and expresses the hope that the kindly relations between the two bodies will tend to the furtherance of the objects they both have in view.

**Large Classes.** Mr. G. Fenton, Secretary of the S.A.T.A., is entrusted with this motion, which seeks to restrict the size of classes to fifty; and so ably does he argue it, that Mr. Small, who seconds, and Mr. Blackstock—the other candidate for the presidentship of the Institute, it may be remarked—who supports, have little difficulty in carrying it *nem. con.* This is the first time that the Congress has touched professional questions, but from the reception accorded, it is quite clear that these questions are occupying the attention of the assistants.

**The Training of Teachers.** Mr. John C. Anderson, M.A., Aberdeen, next discusses "The Training and Qualifications of Teachers." By means of very telling statistics he shows that there is still much work to be done in this direction. He does not think that the pupil-teacher system has outlived its possibilities of usefulness, and what is good in it ought to be retained. He advocates the affiliation of the training colleges to the university, so that the student might learn the theory of his art, might see the theory put into practice by capable exponents, and might practise it himself. He desiderates as much culture as possible for the teacher whose work is in the elementary schools, and who perhaps has to teach all his lifetime boys and girls of the poorest class and from the most unwholesome homes.

Mr. John W. Tait, Leith, moves—"That this Congress of class teachers is strongly of opinion that all teachers should pass through a uniform course of training, this course being extended to include practical training in science; and wholly disapproves of the existing unlimited facility of entrance to the profession." With this carried, we bring a most successful and business-like Congress to a conclusion by according, on the motion of Mr. Wattie, H.M.I.S., a vote of thanks to the President.

**The Luncheon.** At the close of the Congress a number of the delegates present adjourned to the Royal Hotel, where a luncheon was served. Mr. Thomas Shaw, Q.C., M.P., who occupied the chair, gave a very interesting address on education. On the whole, it may be said that all the functions in connection with the second Congress of the S.A.T.A. passed off with much success.

## OUR OLD PARISH SCHOOL.

BY AN OCCASIONAL CONTRIBUTOR.

THERE were kings before Agamemnon, and there were schools before ever School Boards existed. The old parish schools of Scotland were in many ways a notable type of institution. Managed by the church, they existed only indirectly for the church: the first need of the Reformed Church on its democratic basis was an educated laity. But "schooling" has always been more or less one of the necessaries of life to a Scot. Our first Compulsory Education Act is dated 1496, and there were burgh schools of note even earlier. It is, however, the parish school that is the most intensely national of all our educational institutions, and to some extent its influence has happily descended on the Board school. For example, there is no *caste* in education north of the Border. There are no schools properly designated elementary. The Board school is simply a public school; and public school here does not mean a school available only for those of wealth and rank. These public schools do work which is in the main elementary, but they have a curious habit of also sending up to university and other examinations boys who can hold their own with the best product of the secondary schools. And such Board school boys do not necessarily find themselves debarred from the title of gentlemen because of the place where they were educated, which things may be to some good people a great mystery.

Yes, the parish school was a curious place in its way. There the sons of the laird or squire, the parson, and the village cobbler met on precisely equal terms, did the same work so far as their natural gifts permitted, and suffered from the same "tawse" so far as the symptoms of original sin required. When will our modern democracy become so truly democratic? Our younger teachers know such things only by hearsay. Many of us who knew them in our practical experience are apt to become *laudatores temporis acti* when we speak of them.

I wish I could show some of our younger teachers one or two of those schools of the past—I wish I could see them myself; but they are gone, or changed beyond recognition. Their dust would be dear to us; but of some of them no

dust even remains, and as to those that have been changed into Board schools, we can only say that no dust is allowed in a modern Board school.

Here is one of them—a long, low building of one room, standing by the western shore. The murmur of the summer sea without blends with that murmur within which you may have heard even in a Board school, and the atmosphere does not suggest over-pressure or cram. Enter at the open door—it shares with the chimney the duty of ventilation. Along each of the side walls runs a narrow desk, with a high, narrow form, arranged so that those sitting on it are facing the wall—a convenient arrangement this for the master, who can thus see much without being seen.

Down the centre of the room runs a broad, double desk, with a form at each side. Here the pupils sit facing each other; but this place is reserved for the girls and the smaller boys, who are less likely to form dangerous conspiracies together. At the farther end is a wide fireplace—empty now, save for a growing dust-heap and a few broken pieces of slate. But in winter you would find it piled high with a roaring fire of fragrant peats, and in the mornings you would have seen those peats on their way to school, each boy and girl carrying one as a contribution for the common good. And once or twice there may have been among them a contribution, made not so much for the common good as for the common entertainment; for did it not happen that some daring spirit drilled a hole in his peat and inserted therein a small charge of gunpowder, cunningly concealed by a plug of harmless turf, until its presence was revealed by fire? No harm came of it, to be sure—no harm to the commonwealth, seeing that the charge was only what we may call a saluting charge; no harm even to the contriver of the infernal machine, for who could identify the charred remains of the exploded peat, much less trace its ownership?

But now the peat corner is bare, revealed only by the deeper grime on the wall, and occupied only by a few crumbs of oatcake, not there by accident, but as an offering to a half-tame mouse whose occasional presence cheers that corner of the school.

Now let us look at the master. Round and round that central desk he paces, always in the same direction, so that by the sound of his steps each boy can tell without turning his head whether or not he is within the master's field of view. That has its advantages, you can see.

He is a notable man, the master, or might have been, though known to few—completely known to none, indeed. A "stickit minister" we should call him now. Why "stickit" none of us can say. Not for want of learning, surely, for the Old and New Testaments in his pew in the parish church are in the original tongues; and as for Latin—but there is little demand for Latin in this sphere of labour, not during the summer, at any rate, when all the older boys are away herding.

As to his personal appearance, we only note the fact that he is in his shirt sleeves, and for this those of us who have known school work in summer admire and envy him. As to his occupation, he is doing nothing—nothing but thinking, we may add. And that is a big addition. That may be hard enough work; warm enough work, too, even in one's shirt sleeves. The past is clearly with him in this half-hour, after all his reading classes have been heard; for in the summer season, when herding is rife, there is no class in geography or in grammar to hear.

Busy with his fancies is the old man, while his pupils are, or ought to be, busy with their Gray. You don't know what *Gray* means, you younger men. Of course not; how could you? Some of you have studied Euclid, I daresay. Perhaps you did not know at first that you were really studying geometry, and that Euclid was the man who compiled the system of geometry you had to master. Of course the smarter ones among you knew all this before you began the study. You also knew that Euclid wrote other books of geometry besides the eight you had to work through, but that the remaining books were lost when he was crossing a river in flood. And before long you liked to think of that flood; you felt grateful to it. The only fault you had to find was, that the flood wasn't quite big enough and strong enough. You regretted many a time that those eight books had not gone down stream with the others into the bosom of the Ægean Sea. Euclid, at any rate, was your name for geometry. So to those boys we are looking at Gray meant arithmetic. All the old fogies know that Gray wrote a book on arithmetic for schools; some may still believe that he invented the science. Those boys never used the word "arithmetic." Perhaps they would not have known what it meant; certainly they would not have known how to pronounce it. But *Gray*—that was simple enough as a name, even if the book itself was not quite so simple. Still it had to be gone through, even to that hare which was so many of her own leaps in front of the greyhound, enshrined in the memory of every boy of the olden time. When they could solve the problem of the hare and the greyhound, they could leave school when they liked, or stay on and learn Latin.

So our little scholars are wrestling with their Grays in more or less silence, and with more or less diligence. Arithmetic was not *taught*—that is a modern invention. You simply bought your Gray, or inherited one from an elder brother, and you sat down to it and worked on from day to day till you overtook that hare and the greyhound. If you sat more than a week over one problem, you might be found out and accused of idleness, so it was well now and again to get the help of an older boy. To ask help of the master would have been a dangerous innovation.

Meantime the dominie paces his regular round, unseeing now, if not unseen. His head is in the clouds, but his feet are on the earthen floor of his academy, and that is worn into hills and hollows by many smaller feet. A stumble recalls his thoughts to earth again, and he turns his eyes in the direction where, according to the rules of the game, his back ought just then to be turned.

The mouse is out feeding on the crumbs, and a small, silent group of boys is watching it eagerly. Near them is another group in busy talk. This must cease, and forthwith does cease on the well-known call of "*Silence!*" Perhaps you expect to hear of the tawse aiding the voice of the master, as was common in the schools of long ago. The fact is, our master has no tawse. He had possessed many, one pair after another; but during fits of abstraction on the part of teacher—and, in a sense, on the part of the pupils also—they used to disappear. Matter is indestructible, men of science tell us; its form may be changed, but nothing is ever lost. Well, the tawse were as good as lost; their form was certainly changed, and all that could be discovered of them by human sense was a smell of burning leather. Some dominie of old made the discovery that burning the ends of the tawse hardened them into a more efficient instrument of correction. But the boys made a more useful discovery still—that burning the whole of the tawse took away their sting for all time coming, and made life a little more worth living.

Then the good old man, whose income was, after all, a limited one, had turned to nature, instead of art, for help: he sent a boy down to the beach for a supple, business-like tangle. Here was a new problem for the boys to deal with; but a genius arose equal to the occasion. By the aid of the ever-present pocket-knife, the tangle was carefully cut more than half across at intervals of an inch or two. Enough was left uncut to make it look all right. But now, when that ocean-grown cane was used as an instrument of moral improvement, or brought down with a sounding whack on the desk to enforce the call of "*Silence*," there was a great silence for the space of half a minute, a shower of seaweed fragments rattled through the dingy room, and every head bent to its work with a feeling of inexpressible joy.

The picture does not seem to promise well for results, does it? Discipline doubtful; classification rudimentary; premises capable of improvement. There are many tests of a school, as we are beginning once more to realise after a period of educational blindness. The "results" are only to be known in the complete life of the men and women sent out from it, never to be discovered by examination—hardly even by intermittent inspection. And by the results of the parish school we are content that it should be judged. What were its effects on the life of the people and the growth of the nation? Tabulate these results, if you can, before you decide the place of our old parish school as an educational institution.

# EDUCATION ABROAD.

BY E. E. FOURNIER D'ALBE, B.SC., A.R.C.S.

THE reform of French orthography appears likely to become a question of practical pedagogics. The *Journal des Instituteurs* discusses it from every point of view, and summarises the necessary changes thus:—1. Uniform notation of plurals in *s* instead of *x*—*bateaus*, also *je veus*; *x* only to be written when pronounced like English *x*—*silex*. 2. Suppression of double consonants when pronounced single—*siffler*, *alonger*. 3. Suppression of *h* in consonant combinations—*téologie*, *rétorique*, *fénomène*. 4. Substitution of *i* for *y* in the vowel sound—*mistère*, *piramide*; but *balayer*. 5. Suppression of mute consonants—*batême*, *sculture*, *adésion*.

* * * * * *

Such reforms are already sanctioned by Italian usage. But are the advantages really so great as to compensate for this further separation from the older French literature? It is true that reforms are always more or less painful, and take time to be properly appreciated. But what would be gained except a Franco-Italian *rapprochement*? To see *cygne* spelt *cigne* is almost as bad as to see a swan without its long, graceful neck. Possibly the same amount of anatomy might be safely stowed in a diminished space, but the traditions of the swan species would be sadly interfered with.

* * * * * *

The French school system will be well represented at the Paris Exhibition. All departments of school life will be dealt with—the state school and the voluntary school, the day and evening classes, the kindergarten and the continuation school. A circular issued by the Education Department announces that there will be two sections of the school exhibition, one of which will be reserved for the Ministry of Public Instruction, while the other will be open to private exhibitors. The latter will be made use of by an important new organisation, called the Association Générale de la Presse de l'Enseignement, which has, among other things, arranged an exhibition of all the journals devoting space to educational questions. Members of the Association will attend and act as guides to show visitors over the educational collections, and as these members include some of the most capable educational journalists of Paris, a valuable opportunity for studying education abroad will be afforded to foreign pedagogues.

* * * * * *

In an article on School Bureaucracy in the *Zukunft*, Professor Rein makes some very pertinent remarks upon the true duties of an inspector of schools. He says: "A school inspector who is determined to make his own 'method' paramount in the schools of his district, who is bent on having his own way in everything, is far from being an aid to the young and their educators. He takes his pride in the fact that everything goes with external regularity, like a well-oiled machine. Those teachers who have no opinions of their own are his favourites. Happy those who are so made as to be able to accommodate themselves even to the most difficult circumstances! But woe to him who endeavours in the sweat of his brow to develop a firm educational conviction, to acquire a serious and adequate view of his duties.....Contradiction should be tolerated. The abler a teacher, the more sensitive is his educational conscience. He feels bound to measure instructions from outside by his own knowledge. If both agree, all is well; if not, the teacher of character will expostulate, unless he wishes to get into conflict with himself. A wise inspector will welcome this also, if he sees that the teacher is conscientiously endeavouring to fulfil his educational obligations towards the children confided to his care."

* * * * * *

In Samoa, a German school has been for some time established at Apia. This school is subventioned by Germany to the extent of £100 per annum, and this subvention has recently been increased to £170. But even that is not considered sufficient for the growing needs of the school, "in view of the threatened rise of English and American influences." It has been proposed to engage an additional teacher. The Imperial Exchequer not being willing to contribute the further £100 necessary for this purpose, the German Colonial Association has done so, in the expectation that next year the state will take over that obligation also.

* * * * * *

The practice of encouraging German education in colonial territories under German influence is being steadily pursued. At Kiaou-Chow a German school has been established, at present under the personal direction of Herr Kunz, the local missionary. The subjects taught are the reading and writing of German, arithmetic, and a little geography. The school is attended by the interpreter apprentices of the various military camps, who are compelled to attend; and also "by the sons of the better and more intelligent Chinese," who, we suppose, are not compelled as yet!

* * * * * *

The students' riots in Italy have broken out again. Last month Palermo and Naples were the scenes of grave disorders, the students especially in the former place distinguishing themselves by acts of vandalism. As a consequence, the Minister of Education, Signor Baccelli, has ordered the closing of the two universities for the remainder of the winter term. This will deprive the students of a whole term's progress and examinations. The academical councils of the two universities have also been requested to send a circular to the parents or guardians of all the students, declaring that if, after the reopening of the universities, the disorders should recommence, the entire academical year will be lost to the students, and those responsible will be made to pay the damage incurred. At the same time, the question of university autonomy is before the Italian Chambers, and a draft Bill has passed a parliamentary committee. It is hoped that the reforms contemplated will put an end to the disaffection which has for some time been crippling the efficiency of the Italian universities.

* * * * * *

Italian statesmen are endeavouring to make up for the shortcomings of their system of elementary education by taking advantage of every opportunity of instructing their numerous soldiery. In Rome, Dr. Vittorio Nazari has for some time been conducting classes in the principles of agriculture. The *Rinnovamento Scolastico*, the chief educational journal of Italy, describes one of these classes, which usually are held on Sundays. The lecturer dealt with manures and their practical application. General Bruto Bruti—I hope he is better than his name—commanding the royal *carabinieri*, exhorted the soldiers at the end of the lecture to remember all that had been so clearly explained, and to utilise this knowledge for their own benefit and for the advancement of the country. Subsequently an excursion was organised into the fields about Rome, to inspect the various ways of cultivating the land as actually practised. Let us hope that in some future lecture the doctor will deal with the method of converting bayonets into ploughshares, for the advancement of the world at large.

* * * * * *

Göttingen can claim the credit of having been the first city to introduce the school bath, which it did some fifteen years ago. The arrangement most favoured in Germany consists of two rooms, one for dressing and the other for the bath proper. The latter contains a large stove for heating the water, and a proper arrangement for mixing enables the attendant to control the temperature of the douche (for that is the best form of the bath), which should be between 60° and 85° F. The roses are fixed in the ceiling, and a number of children can bathe at the same time. The whole floor is well drained, and covered with wooden trellis. The time allowed for the whole process is twenty minutes, and every pupil receives at least one bath per week. Quite apart from the promotion of school hygiene, the creation of clean habits is an inestimable gain. In the majority of cases, it is pretty certain that not a drop of water would reach the bodies of the children from year's end to year's end, the daily ablutions being confined to the face and hands.

# OUR CLASS ROOM AIDS

## LESSONS ON THE STARS.

### III.

### The Distance of the Sun.

THE sun is the nearest of the stars; its mean distance from the earth is about 93,000,000 miles.

Let us try to form some idea of the magnitude of this distance. Suppose a great explosion were to occur on the surface of the sun. The light produced, travelling at the rate of 186,000 miles per second, would reach us in $\frac{3}{1000000}$ seconds—that is, in 5,000 seconds, or 8⅓ minutes. If the noise of the explosion could reach us, then the sound, travelling at its ordinary rate of 1,125 feet per second, would arrive at the earth in about 14 years after the explosion. If a message could be sent by railway to inform us of the details of the explosion, and if it were able to travel at the rate of 45 miles per hour continuously, then it would take about 240 years to reach us.

Although this distance is so great, yet, compared with the distance of the nearest fixed star, it is really very small. The nearest fixed star is thousands of times farther from us than is the sun; in fact, the whole solar system—that is, the sun with the whole of the planets travelling round it—may be regarded as being isolated, and unaffected by the other stars, so far are they from us.

### The Solar System.

The solar system consists of the sun as a large central body, together with eight major planets (Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune) and a large number of smaller planets, or asteroids, all revolving round the sun. The earth may be regarded as a floating body half immersed in a sea, and revolving round the sun, also half immersed. The surface of such a sea would represent the plane in which the earth moves round the sun. This plane is called the plane of the ecliptic. The other planets move round the sun in planes only slightly inclined to this. The earth, then, travels round the sun in this plane, and rotates on its axis at the same time. Now the axis of rotation of the earth is inclined to the plane of the ecliptic at an angle of 66½°—that is, the earth's equatorial plane and the equinoctial are inclined to the ecliptic at an angle of 23½°.

On the globe you see a thick black line below the equator. This represents the ecliptic. The sun appears to move across the celestial sphere along this line, but it is really the earth revolving round the sun once in 365¼ days that gives rise to this apparent movement.

The planets moving round the sun nearly in this plane also appear to us to move very nearly along this line, but their movements do not appear to be regular. Sometimes they appear to be moving from east to west, sometimes from west to east, and sometimes they appear to stand still. It was on account of their apparent irregular motions amongst the stars on the celestial sphere that they were termed planets or wanderers.

This apparent irregularity in their motions is due to the position from which we view the planets. If we could see them from the centre of the solar system, they would all seem to move in the same direction along the ecliptic, but at different rates. If we look at the planets through a good telescope, we find that they do not appear as points of light, but present different appearances at different times. Sometimes they appear as bright discs of light, sometimes they appear as bright crescents, and seem to change gradually, just in the same way as the moon does. Hence we speak of the phases of the planets in the same way as we speak of the phases of the moon.

In the case of the fixed stars, the larger and the better we make our telescopes, the smaller the images in the telescopes become; but in the case of the planets the images become larger. This is because the planets are comparatively near to us, and the apparent size of the fixed stars is due to diffraction of light, which is overcome by a good telescope. When we look at the planets through telescopes, we see markings on their surfaces; and if we make observations night after night, we see that the marks seem to travel round the planets, disappearing on one side and reappearing on the other after a considerable interval. This seems to indicate that the other planets, in the same way as the earth, rotate in addition to revolving round the sun. We also find that the marks move in planes parallel to each other, but inclined to the ecliptic. If the marks have no motion of their own on the surface of the planet, but only move with the planet, then they will appear to move in planes parallel to the equator of the planet and at right angles to the axis of rotation. Hence, if we measure this angle, we can tell what is the inclination of the planet's axis to the ecliptic. Again, if we determine the time occupied by the marks in going round once, this will give us the time of rotation of the planet, or the length of one day and night on the planet.

This method of finding the inclination of the axis and the time of rotation has answered well in the case of Mars, Jupiter, and Saturn, but it is not so easy a matter in the case of the other planets. Mercury and Venus are so near the sun that it is difficult to make observations. In the case of Uranus and Neptune we also find it difficult to get information, because of their great distance. We are never much nearer to Uranus than 1,700,000,000 miles, and when we are nearest to Neptune we are still about 2,700,000,000 miles away; so it is easy to understand how difficult it is to make reliable observations at such distances.

The planets revolve round the sun in the same direction as the earth, but not in the same time. The time of revolution can be easily ascertained, and is found to be very different for the different planets, varying from 88 days in the case of Mercury to 60,181 days in the case of Neptune.

It is found that many of the planets have smaller bodies revolving round them, just as the moon revolves round the earth; but these will be mentioned in the descriptions of the several planets.

We have seen that the planets revolve round the sun in planes which are only slightly inclined to the plane of the ecliptic, but their distances from the sun are very different. Each planet travels round the sun in an elliptical path or orbit, so that its distance from the sun is less at some times than at others. The mean distances of the planets from the sun in millions of miles are, roughly, as follows:—

| | |
|---|---|
| Mercury, 36. | Jupiter, 483½. |
| Venus, 67½. | Saturn, 886¾. |
| Earth, 93. | Uranus, 1,783¼. |
| Mars, 141½. | Neptune, 2,794. |

The relative sizes of the sun and planets are well shown by the figures on the map.

Having now got a general idea of the solar system, we shall proceed to study each of the important members in more detail.

### The Sun.

The sun appears to us to be a far larger and brighter star than any other. Some of the other stars, however, are known to be hundreds of times as large as the sun; but they are at far greater distances away, and so look small in comparison.

The sun is a tremendous globe of matter, at a temperature far higher than any we can imagine on this earth. The diameter of the sun is at least 867,000 miles—that is, more than 100 times as great as the diameter of the earth. An express train travelling at the rate of 60 miles per hour continuously for seventeen days would travel a distance nearly equal to the circumference of the earth; but travelling at the same rate, it would take about five years to go round the sun. Although the sun is so great in bulk, it does not contain nearly so much matter as we should have expected. In consequence of its excessively high temperature, a great portion of it, and certainly the outer portion, exists in the form

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of gas or vapour. The temperature is so high that even such metals as copper and iron exist in it in the form of vapour. In bulk the sun is more than 13,000,000 times as large as the earth, but in weight only 330,000 times as great; in fact, bulk for bulk, it is only about one-seventh as heavy as water, hence the *main bulk* is probably in the gaseous state.

In examining the sun by means of a telescope, great caution is necessary, or the observer's eyes may suffer. Many persons have had their eyes injured, and several astronomers have had their sight destroyed, by looking at the sun through telescopes. The attempt should not be made, even with the smallest telescope, except under the guidance of an experienced observer. Dark-coloured glasses are placed in the path of the light before it reaches the eye, and so the greater portion of it is cut off. The first thing that strikes us when we look at the sun through a large telescope is the number of spots on its surface. These appear most numerous a little above and below the equator. The spots seem to have a movement of their own, as well as to move round with the sun. Those near the equator move more quickly than those farther away. One of these spots is shown on the top right-hand corner of the map. The lightly-shaded portions are called the half-shade or penumbra. The darker shade next the penumbra is the umbra, and the darkest portion of this is termed the nucleus.

These sun-spots are really large rents or holes in the atmosphere of the sun, the darkest portions representing the deepest parts. This is plainly seen when one of the larger ones reaches the edge of the disc, where it appears as a notch. Across some of the spots we see bridges of luminous matter. The spots are no doubt due to disturbances taking place within the sun, and they are always changing in shape. Besides these spots, there seem to be distributed over the sun's surface bright streaks of various forms, termed faculæ. These are the brightest portions of the *photosphere*, or luminous surface of the sun. The sun gives out its light and heat into the space around, and keeps the planets in their paths by its attraction.

## Mercury.

Of the planets, Mercury is the one nearest the sun. It is the least in volume and in mass, but has the greatest density. The inclination of the orbit of Mercury is $7^{\circ}$, and this is greater than that of any of the other planets. The time of rotation is about 88 days, and appears to be about the same as the time of revolution, so that it will always present the same face to the sun. This side will always be bright, and the opposite side always in darkness.

## Venus.

Taking the planets in order of distance from the sun, Venus comes second. Its time of rotation is about 23 hours 21 minutes. Sometimes Venus passes between us and the sun, and then appears on the sun's disc as a black spot. Such a passage is spoken of as a *transit of Venus*. The time of revolution of Venus is about 224½ days. Venus is about nine-tenths the volume of the Earth, but has very nearly the same mass.

## The Earth.

The Earth is the third planet in order of distance from the sun. Its diameter is 7,927 miles—a little greater than that of Venus. Its density is about five and a half times that of water. Its time of revolution round the sun is 365¼ days, and its time of rotation on its axis one sidereal day, or 23 hours 27 minutes 24 seconds of mean solar time.

Its rotation on its axis is the cause of the apparent rotation of the celestial sphere, and the slope of its axis is the cause of the seasons. It has one satellite or moon, which revolves round in the same time as it rotates on its axis, so that it always presents the same face to the earth.

Our moon appears to be a cold body, with no atmosphere. We can see the surface quite well, and can plainly see on it gigantic extinct volcanoes, a crater of one of which is shown on the top left-hand corner of the map. The deep shadows cast by the sides of the crater are plainly seen.

## Mars.

Mars is the fourth planet in order of distance from the sun, and revolves round the sun in 687 days. Its time of rotation on its axis is 24 hours 37 minutes 23 seconds; so we see that the four planets nearest the sun rotate on their axes in about the same time.

The inclination of the equator of Mars has been determined with great precision, because we are able to see the markings on the surface.

The atmosphere of Mars is less cloudy than that of any other planet. The climatic conditions on Mars probably resemble closely the conditions prevailing on the Earth. Round its poles we can see distinctly large areas covered with snow, just as in the case of the Earth. This shows that the atmosphere must contain a large amount of moisture, from which this snow is derived. In winter the snow-cap extends to a latitude of 45°, but in summer much of it seems to melt away.

So well have the surface-markings of Mars been examined that its surface has been mapped out into seas, oceans, and continents, just as we map out the surface of the Earth.

Mars has two small satellites, which were discovered in 1877.

## Jupiter.

Jupiter is much larger than the other planets, and is also very bright. Seen through the telescope, Jupiter presents the appearance of a planet covered with clouds. It is owing to the reflection from these clouds that Jupiter appears so bright. We are quite unable to see the planet through the dense vapours of which these clouds consist, so we can learn nothing of the surface of the planet itself.

There are generally streaks or belts of a darker shade crossing the bright disc in bands roughly parallel to the equator. These bands are known as the *belts* of Jupiter. They vary very much in appearance as the clouds move. Occasionally bright spots also appear, and by the movement of these we have been enabled to discover that the time of rotation of Jupiter is 9 hours 55 minutes 28 seconds. The time taken by Jupiter to travel round the sun is 4,332½ of our days, and this is therefore the length of one year on Jupiter.

Jupiter has four satellites or moons revolving round it, and these produce eclipses of the sun with respect to Jupiter, and are themselves sometimes eclipsed by the planet. The times of these eclipses are calculated by astronomers in advance, and published in the *Nautical Almanac*; and since they appear to occur at the same moment when viewed from different parts of the earth, advantage is taken of this by sailors to check their chronometers.

## Saturn.

Next in order after Jupiter comes Saturn. Saturn's time of revolution round the sun is about 10,759 days, or about 29½ years. Its mean diameter is about 71,000 miles, so that it is 740 times as large as the Earth; but in mass it is only 95 times as great, and it is therefore less dense than water. It revolves on its axis in about 10 hours 15 minutes, and the inclination of its axis is about 28°. Saturn, like Jupiter, seems enveloped in clouds, and shows belts in the same way, but these are not so well seen as are Jupiter's belts.

Round Saturn we notice a very remarkable appearance. Round the planet, in its equatorial plane, we observe three rings. These rings are like three discs pierced with large holes, and placed one outside the other. The inner one is only faintly luminous, but the two outer ones are much brighter. These rings probably consist of small masses of matter revolving in circular orbits round the planet.

Saturn has eight satellites. The largest one, Titan, has a diameter of 3,300 miles, so that it is larger than Mercury. The farthest one from the planet is Japetus, and this is over two million miles distant.

## Uranus and Neptune.

Little is known of Uranus. It appears to be about 64 times as large as the Earth, and to have a density less than one-fourth that of the Earth. Its time of rotation is probably about 10 hours. It probably has a dense atmosphere like Jupiter and Saturn. It has four satellites, but their dimensions are not known with certainty.

Neptune is so far away that no markings can be seen on its surface, and so its time of rotation is unknown. Seen from Neptune, the sun would appear only as large as Venus appears when nearest to us, so that the light and heat received from the sun must be very small. The diameter of Neptune appears to be about 36,600 miles, so that it is a little larger than Uranus, whose diameter is about 33,560 miles. Neptune has a density about one-fifth that of the earth.

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# NOTES OF TWO LESSONS.

*By* WILLIAM DONE, B.A., *Head-Master of Brighton Pupil Teachers' School.*

(See Supplement presented with this Number.)

## I.—NEEDLES.

| HEADS. | MATTER AND METHOD. |
|---|---|
| 1. Preliminary Examination of a Needle. | Have packets of needles at hand showing the various sizes, and how the needles differ in length and thickness. Elicit the utility of this. Compare a needle and a pin as to colour and elasticity, hence infer some of the qualities of tempered steel and of brass. The former is harder, more elastic, and takes a finer point than the latter. |
| 2. How a Needle is made. (*a*) *Steel wire.* | The first process in the making of a needle is to obtain steel wire of the finest quality, carefully drawn into varying degrees of thickness, according to the size of the required needle. The wire, in the form of large coils, is thus the raw material supplied to the manufacturer. |
| (*b*) *Wire cut into lengths and straightened.* | The workman cuts the coiled wire into lengths sufficient, severally, for two needles. These lengths are slightly curved, having formed a portion of the coil; they are straightened by being made into bundles, heated, and rolled backwards and forwards on an iron plane. |
| (*c*) *Pointed.* | The grinder now takes a good number of these double lengths to the grindstone, and by revolving them between his finger and thumb, causes the ends to take a point. By reversing the needles in his hands, he points the other ends. |
| (*d*) *Stamped.* | The next operation is a delicate one. The place for the eye of the needle has to be stamped, which is done by means of a blow from a hard steel die. This, of course, somewhat flattens out the head, as seen in the diagram. |
| (*e*) *Punched.* | A steel punch, fitted into a press, is caused to descend sharply into the stamped eye and punch the hole through. |
| (*f*) *Projections filed away.* | We noticed the projections caused by the die in stamping for the eye. These projections have to be filed away. For this purpose, the double needles are threaded on fine wires or *spits*. After a number so threaded have been clamped at both ends, the projections or *birs* are filed down. |
| (*g*) *Divided.* | The whole clamped mass is next filed through the middle, so that at last the double needles are divided. |
| (*h*) *Finished.* | The needles, however, are by no means finished yet. The eye has to be *burnished*, so as to make it perfectly smooth, in order not to fray the thread which it will afterwards carry.<br>Next the needles have to be *hardened*, which is done as usually with steel goods—namely, by first being made red-hot and then plunged into cold water or oil. They are then *tempered*, to render them less brittle, by being slightly heated and suddenly cooled.<br>Further processes are *polishing*, *drilling*, and *setting the points*, after which the needles are ready for packing in sets, as we have them here. |
| 3. Where made. | Needles are chiefly made in Worcestershire, in and around the town of Redditch. |
| 4. Conclusion. | Steel needles, as we know them, have been made in England only since the reign of Queen Elizabeth; but the needle is such an indispensable article for fastening wearing apparel, etc., that in some shape or form it has existed from remote antiquity. Indeed, remains of bone needles have been found in the deposits left by lake dwellers ages before duly-recorded history commenced. |

## II.—PINS.

| HEADS. | MATTER AND METHOD. |
|---|---|
| 1. Preliminary Examination of a Pin. | Have pins of various kinds distributed to the class. If possible, also, a few old-fashioned pins, in which the head is not all in one piece with the shank, would be useful. The colour of modern pins should be noted—black, slightly yellow, and white. Some of them, if scraped, will be found to be made of brass, some of iron. |
| 2. How a Pin is made. | We see in the diagram the picture of the raw material as supplied to the pin manufacturer. |
| (*a*) *The brass or iron and the drawn wire.* | Being of a comparatively soft nature, it can be drawn out into wire of varying degrees of fineness by passing it through holes in a steel plate. |
| (*b*) *Wire straightened.* | To straighten the wire and render it strictly uniform, the coil is placed on a revolving wheel, and passed through a number of iron pegs set upright on a plane. |
| (*c*) *The pin shaped by a machine.* | In olden times, after this stage there were several operations, such as cutting the wire into proper lengths, pointing one end, and making a head for the other by means of a piece of finer wire twisted round it. We can see this distinct head in our old-fashioned specimens. But now a pin is made all in one piece, and the whole of the processes are done by one machine.<br>This instrument cuts off from the coil of wire a piece sufficient for one pin. The pin length is passed on by the machine and held between a pair of steel dies, where the head is stamped by means of a punch. The pins fall from the dies into a slit, where they hang suspended by their heads. Here they are pressed against a revolving wheel by means of a steel rod. The pins rotate on the wheel, and so are pointed. |
| (*d*) *Cleaned and whitened.* | To clean and whiten the pins, they are boiled in an acid liquor with powdered tin. The acid not only cleans them, but, by dissolving the tin, causes that substance to coat the pins. |
| (*e*) *Polished.* | After a final cleansing with boiling soapsuds, the pins are placed in bags or barrels of bran or sawdust and shaken about. This finally dries and polishes them. |
| (*f*) *Papered.* | A machine, called the sticking-machine, is used to stick the pins into the crimped paper, as noticed in the diagram. They can be placed in rows thus at the rate of about one row a second. Sometimes, however, pins are sold loose, by weight. |
| 3. Conclusion. | The number of pins used daily is astonishing. It amounts to about three per head of the population. Birmingham is the great seat of manufacture, though quantities are made in various parts of Gloucestershire, where the industry was originally introduced about three centuries ago. Before this time pins were made by hand, and were large and clumsy. Bone, wood, ivory, bronze, and silver were substances employed for this purpose, and many examples may be seen in our museums of such pins. |

**See THE PRACTICAL TEACHER'S ART MONTHLY for ANIMAL STUDIES FOR SCHOOLS. New Schemes of Drawing appear Monthly.**

***Order April Number.***

# ELEMENTARY LESSONS IN THE PRINCIPLES OF GRAMMAR.

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## LESSON IV.

### PLACE, TIME, AND CAUSE.

EVERYTHING we see around us is in a certain place:—

The book is on the desk.
The desk is against the wall.

We can thus state the position of a thing by naming something near it. We know the position of the picture by noticing the wall, and, putting our knowledge into words, we say,—

"The picture is on the wall."

If a pen is held first in one place and then in another, and if each time you are asked to state the position of the pen by naming the desk, you will reply,—

"The pen is *on* the desk,"
"The pen is *under* the desk,"
"The pen is *over* the desk,"
"The pen is *against* the desk,"

according to the position of the pen.

We will call "on," "under," "over," and "against" position-words, because they go before the name of a thing to indicate the position of something else.

"On," "under," "over" do not by themselves show position, but bring in or introduce the name of something which shows the position. The pen is thus connected with the desk. The pen and the desk are said to be *related* in place, and this connection is called a *relation*.

Things are also connected or related in *time*:—

The cradle is *before* the grave.
Tom came to school *after* Mary.

The grave is mentioned to fix the time of the cradle. Mary is mentioned to fix the time when Tom came.

The words "before" and "after" introduce things to fix position in time.

Words which come before nouns or pronouns to introduce things to fix time or place are called *prepositions*. *Pre* means "before."

Things are sometimes connected or related together in other ways than in time and place. When one thing always goes before another in both time and place, the first is often said to be the cause of the second, and the second the effect of the first. The sun is the cause of heat. Words which introduce the name of a thing to fix *cause* are called prepositions; for example,—

The injury is *from* the blow.

The blow is said to be related to the injury. The connection is called a relation. But we must make up our minds to understand things before words. So we will speak of time, place, and cause, and not use the word "relation," which may mean almost any kind of connection.

Our best way to remember the class of words called prepositions will be to learn a list of them, remembering that they all must name some object to fix position in time or place.

A good help to remember a number of them is to think of a train *at* the station, *after* or *behind* the train which left *before* it. The train goes *from* the station *upon* or *along* the rails, *between* the sides, *above*, *over*, *under*, or *below* the bridge, *into*, *in*, *within*, and *through* the tunnel, *past* the signal-box, *towards* the town, and arrives *near*, *at*, or *inside* the station. The passengers stand *beside* or *against* the train. Porters move *amid*, *among*, *around* the people.

### MEMORY NOTES.

A preposition is a word which goes before the name of a thing to fix time, place, or cause.

*List of Prepositions.*

| | | | | |
|---|---|---|---|---|
| about | before | down | off | under |
| above | behind | during | on | underneath |
| across | below | except | over | until |
| after | beneath | for | past | unto |
| against | beside | from | through | up |
| along | between | in | till | upon |
| amid | beyond | inside | to | with |
| among | but | into | towards | within |
| around | by | near | | without |
| at | | | | |

## LESSON V.

### ADVERBS, CONJUNCTIONS, INTERJECTIONS.

We can now make statements or sentences by—

1. Naming things by nouns or pronouns.
2. Stating what actions they perform.

The boy plays.
She runs.

If I ask you *when* the action is done, you may reply "now," "to-day," "to-morrow," without bringing in things:—

I write *now*.
He came *yesterday*.

In like manner, we may give the *place* of an action by such words as "here," "there," "away," without naming things:—

He comes *here*.
The boy ran *away*.

We may also state *how* actions are performed—as, "well," "badly," "quickly":—

He writes *badly*.
Tom ran *quickly*.

Most of these words end in "ly," meaning "like." Without the "ly" the words are chiefly adjectives, expressing the qualities of things.

Words which are used to express how, when, and where an action is performed are called *adverbs*, because they are generally used with verbs, and refer to the action expressed by verbs. *Ad* means "to."

Tom killed the cat yesterday.

"Yesterday" gives the time of the killing, not the time of Tom or the cat, for they existed at other times, whereas the killing occurred *only* at the time indicated by the word "yesterday."

*Adverbs* are connected with verbs, as adjectives are with pronouns or nouns.

Adjectives describe things by stating their qualities:—

Tom is *happy*.
The butter is *sweet*.

Adverbs describe actions by stating time, place, or manner:—

He comes *now*.
The girl stands *there*.
Boys run *fast*.

#### CONJUNCTIONS.

Sometimes we link things and actions together, and represent the connection by such words as "and" and "but":—

Tom *and* Mary behave well.
Tom is quick, *but* Mary is slow.

We may notice that "but" is used when we join together, in order to oppose or contrast the meanings. Joining-words are called *conjunctions*.

#### INTERJECTIONS.

A sudden feeling of joy, surprise, pain, or sorrow is expressed by an exclamation, as "oh!" "alas!"

Such words are called *interjections*, and are followed by a note of exclamation (!).

We have now mentioned all the classes of words. These classes are called Parts of Speech. They are:—

1. *Pronouns.*—First-names which distinguish the speaker and hearer from other persons and things.
2. *Nouns.*—Names for anything that can be spoken about.
3. *Adjectives.*—Words attached to nouns or pronouns to state the kinds or qualities of things.
4. *Verbs.*—Words by which a speaker makes an assertion. Most verbs also express action.
5. *Prepositions.*—Words going before nouns and pronouns to indicate time, place, or cause.
6. *Adverbs.*—Words used with verbs to indicate time, place, or manner.
7. *Conjunctions.*—Words used to show linking or joining together.
8. *Interjections.*—Words used to express sudden emotions.

Every word has to be placed in one of these eight classes, according to the way in which it is used.

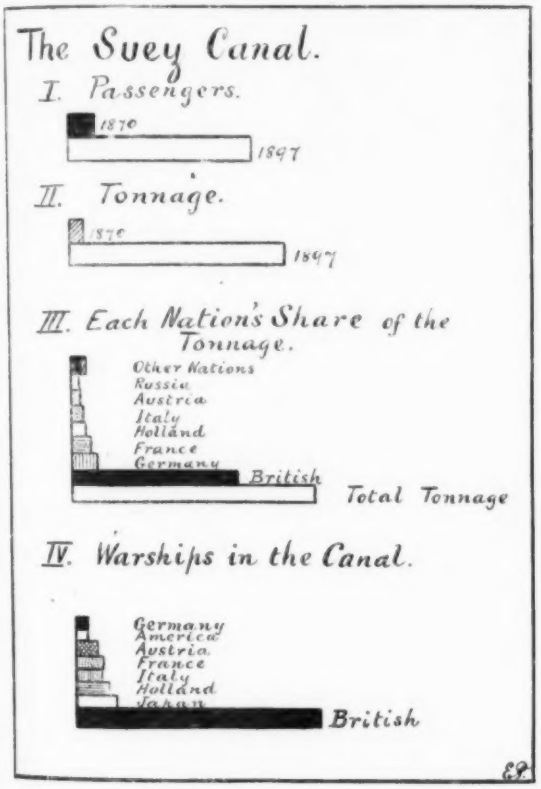
### MEMORY NOTES.

A word used to name anything is either a *noun* or a *pronoun*.
A word used to make an assertion is a *verb*.
A word used with a name to indicate a quality in a thing is an *adjective*.
A word used with a verb to indicate time, place, or manner is an *adverb*.
A word used before a name to fix position is a *preposition*.
A *conjunction* is a link-word.
An *interjection* is an exclamation.

# OUR NEWSPAPER NOTEBOOK.

## THE SUEZ CANAL.

THE latest available statistics concerning the Suez Canal are particularly interesting compared with those of 1870, the year immediately following the opening of De Lesseps' great work.




**Passengers.**—In 1870 the number of passengers conveyed through the canal was 48,422; in 1897 the number was 191,125. (Diagram I.)

**Tonnage.**—In 1870 the total tonnage of the vessels amounted to 436,609; in 1897 this had increased to nearly 8,000,000. (Diagram II.)

Our interest in the canal is abundantly justified by the fact that in the three years 1895–97 nearly 70 per cent. of the vessels using it were British. German vessels were 9 per cent., French less than 7 per cent., and Russian but 1·5 per cent. (Diagram III.)

**Warships.**—In the matter of warships traversing the canal in 1897, Britain is again very easily first. It would appear strange that Japan should be second, did we not bear in mind that Japanese war-vessels are constructed in Europe, chiefly in British yards. (Diagram IV.)

## UGANDA RAILWAY.

Though it is generally admitted that there is no greater ally of civilisation than railways, news from Uganda would seem to indicate the need for care in planning and building railroads in those parts of the world with which we are yet but little acquainted. In 1895 the British Government voted £3,000,000 for the construction of the Uganda Railway from Mombasa to Uganda. The greater part of the money has been expended, and the line is completed for only about one-third of the distance.

The line commences at Kilindini, on the island of Mombasa, and is carried over the strait, 600 yards wide, to the mainland by a bridge. Regardless of the fact that these waters were infested by worms particularly destructive to wood, the bridge was largely composed of teak, and in little over a year it was found necessary to replace it with a structure of iron.

Leaving the coast, the line passes through fifteen miles of desert, and then seventy or eighty miles of dense jungle. At present the line stops at about two hundred miles from Mombasa, and there are such natural difficulties ahead that another route is being searched for. It is stated that originally wooden sleepers were used, which after a time had to be replaced by steel sleepers, owing to the ravages of ants. The supply of water, too, along the line is woefully inadequate and uncertain, at least for the first one hundred and twenty miles; and the water that is obtainable is so strongly impregnated with salt that the engine boilers are corroded through in a few months. But this is not all. Now that the Cape to Cairo line is under discussion, it is found that the gauge of the Uganda line is 3 feet 3 inches, while that of the Bulawayo line is 3 feet 6 inches, so that the engines and carriages of one line will not be able to run over the other.

Much of the work of construction has been done by the aid of coolie labour imported from India. During the last three years, it is estimated, quite eight thousand coolies were landed. At the present time there are not more than three thousand employed on or about the line, and it is stated that the remainder have perished of fever, lack of water, and the attacks of lions, leopards, and hyenas; and an eye-witness says, "The bones of the poor wretches may be seen lying whitening in heaps in the jungle." There is small room for wonder that the Hindu journals are warning coolies of the risks they run in accepting engagements in this particular portion of the British Empire.

There is no doubt that the Uganda Railway is at present a very long way from fulfilling the hopes of its promoters. The present failure, however, is no argument against the ultimate success of railways in Equatorial Africa, and doubtless in the further prosecution of the line the engineers will be able to profit by the experience of past errors. The regions through which the railway passes are reported to be pestilential, fever-stricken, and infested by wild beasts and noxious insects, and it is said there is not the remotest possibility of European settlements ever growing up along the two hundred miles of line already constructed. This, however, is a matter of opinion, and time alone can prove the value of the territory.

## HANDS ACROSS THE SEA.

**Imperial Penny Post.**—We are able to afford our readers an illustration of the stamp issued by Canada for the New Imperial Penny Postage. The design seems but one more

proof of the genuine pride of the Canadians that they belong to that vast empire so admirably depicted in the stamp. The black in the engraving represents red in the actual stamp, which is half the size of the illustration.

## RUSSIAN NOTES.

**Nijni-Novgorod, Bobroff, Astrakhan.**—Nijni-Novgorod has a population of about 80,000, which is increased at least fourfold during its great annual fair (July to September). Notwithstanding its size and importance, a horse was recently drowned *in the mud* within the boundaries of the township. Road-making is evidently an art still to be acquired by the Russians, for at Bobroff matters are still more deplorable. The railway station is just outside the town. In autumn the mud is so deep that goods have to lie in the railway warehouses until dry weather, for no vehicle can pass. Passengers wade to the station knee-deep in mud, the luggage being carried on the backs of peasants. To add to the general unpleasantness, only one train a day leaves the town, and that in the middle of the night. Astrakhan, the chief town of the Caspian region, has a population of 75,000; yet the nearest railway is at the German colony of Sarepta, 220 miles away.

**Matches.**—Canes eighteen feet high and an inch thick grow abundantly on the plains on the north-west coast of the Caspian Sea. It has been found that the canes make excellent matchwood, while the thicker stems are utilised for making cylindrical match-boxes.

**Wine.**—Large quantities of wine are annually exported from the Crimea to France, from which it again issues as higher-class burgundy.

**Eggs.**—In 1898 Russia exported 240,000,000 eggs, half of which came to Great Britain.

**Famine.**—In the Government of Samara, owing to lack of winter work, the peasants are very near starvation. The only available bread is composed of a mixture of flour, chaff, and acorns, in the proportion of 1, 1, and 6. The mixture, of course, by no means resembles flour, and the baked article looks more like bricks than bread.

**Village Industries.**—Russia is showing a remarkable development of village industries. The peasants of even a widely-scattered district build a factory for common use, where they weave, or make furniture, agricultural implements, and metal work of all descriptions. Many of these village products find their way to markets as far distant as Persia and China.

# THE PRINCIPLES AND PRACTICE OF CLASS TEACHING.

## GEOGRAPHY.—(*Continued.*)

### Explanation of a Map.

DESCENDING now from what we should *like* to teach to what we *must* teach, the problem of maps and plans first faces us. **The idea of a plan** is not at first an easy one to grasp, and in the *drawing* course for schools it is wisely left over for a considerable time. The simplest way is to **begin with the table** in front of the class, having arranged on it two or three things, such as a book, an inkstand, or one or two drawing models from a senior room. Such models as a cone or a pyramid should be preferred, on account of their plan differing so much from their actual shape. The table may first have a line drawn through its middle point lengthways, and another across, so as to divide it into four equal parts. If the table is a small one, so much the better, for the teacher will be able to draw his first plan of it on the blackboard to the actual scale, the **measurements being made by the pupils themselves.** Having drawn an oblong of the proper length and breadth, and represented on it the two medial lines drawn on the table, the teacher next gets from the pupils the measurements of the bases of the models on it, and their distance from the two medial lines, or from two contiguous edges of the table. Then if the blackboard be a movable one, it should be held horizontally beside the table, and the pupils will see for themselves the relation between the actual form of objects and their plan. The lesson may be several times repeated, with the objects on the table or their position varied each time.

The second stage is to introduce **the idea of scale.** The simplest to begin with will be half the actual size, or six inches to the foot. After each measurement made by the pupils, they should be required to inform the teacher **what number of inches the line will require to be on the plan.** Afterwards a smaller scale, such as three inches to the foot, may be used, and the two plans of varying scale may be drawn side by side on the board.

The next step will be to begin the **plan of the class-room.** Every measurement should again be made by the class with a suitable tape measure. The side and end wall should be measured, and the pupils asked to suggest such a scale as will enable the plan to be put on the board—such as one inch to the foot, or in large rooms half an inch. For the first lesson, only the walls, with the position of doors, windows, and fireplace, should be attempted. This plan, or its measurements, should be preserved for the next lesson, when the position of the teacher's table and the rows of desks may be ascertained and represented.

These lessons should be continued as long as may be necessary to make clear the two points involved—(1) **the meaning of a plan,** and (2) **the idea of scale,** as determined by the size of the surface to be drawn on compared with the size of the surface to be represented. The teacher may proceed next to include on his plan certain broad features **outside the room,** such as the direction of the passages leading to it, and the cloak-rooms. At this stage exact measurements may be dispensed with, and the length of the room itself taken as the standard.

> It is quite unnecessary in the case of a large school to proceed to draw the plan of all the rooms. The most instructive exercise will be to give merely the block-plan of the school, marking on it the class-room in its general proportion to the rest of the building, and then to draw the plan of the playground. This will again necessitate a change of scale, in itself a very important exercise.

To this smaller block-plan should be next added the chief lines of street or road by which access is gained to the school by the pupils, and here it will be advisable to introduce the idea of the **cardinal points of the compass.**

The simplest method of doing so, and the method which will always be of most practical use to the pupils in after-life, is to **refer to the position of the sun and of the pupil's shadow at midday.**

> Some teachers have a meridian line drawn or marked in some way on the floor or roof of the class-room. This only applies to the particular room where it is marked, and does not give any power of determining that line by the pupils themselves in any other situation. And so long as the lessons are confined to the plan of the room alone, it is not the meridian line but the idea of scale that is the important point.

In further exercises on plans, the block which represents the school will be arranged in the conventional order, with the north to the top of the blackboard; but the teacher should be careful to make it clear that this is **merely a conventional arrangement.**

A prepared map of the district of the town or country immediately surrounding the school should next be used, on a scale large enough to show the shape of the playground, as a transition to the use of maps in which the scale will not permit of showing more than the position even of the town or village itself. This may mark the conclusion of the series of exercises, and the pupils should then have a fair knowledge, so far as is possible at their age, of what a map means.

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**The Story of the North-East Passage, as told by the Early Explorers.** Nelson's Supplementary Readers, No. I. 96 pages, with Map and Illustrations, 3d. The issue of this Reader is a very happy thought. *Hakluyt's Voyages* are full of that kind of incident and adventure which lads are so fond of, yet this is presumably the first time that "the great prose epic of the modern English nation," as Froude describes the work, has been presented in a form suitable for the scholars of primary schools. Our upper standard boys will revel in this healthy English classic. Skilfully edited, well printed, intensely interesting, ridiculously cheap, and admirably suited for the purpose for which it is intended, teachers have only to see and know it, and they will at once introduce it into their schools.

# THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

"Flowers o' the spring....daffodils,
That come before the swallow dares, and take
The winds of March with beauty."
*Winter's Tale*, Act IV. Sc. 4.

**The appalling Ignorance of Nature.** THE investigations of Miss Dodd, L.L.A., have disclosed appalling ignorance of the beauties of Nature amongst some town children. Of course, the results may be said to have been expected. There are some who do not deplore them. For my part, not to know anything of Nature spells no conception of beauty. The great problem is how to palliate this distressing state of things. Let all who have the opportunity give Nature lessons, and so instil a love of Nature; peradventure some may be kept from the whirlpool of the congested centres of population. There is some comfort in the fact that the investigations referred to were made in the smokiest and most congested part of England. So far they can be considered as taken under abnormal circumstances.

* * * * * *

**"Let Nature be your Teacher."** Books are useful, but do we not rely too much upon them?

"Books! 'tis a dull and endless strife.
Come, hear the woodland linnet:
How sweet his music! on my life,
There's more of wisdom in it."

Nature teaching is the most interesting part of the curriculum. As Wordsworth says,—

"Sweet is the lore which Nature brings."

In the same poem the great poet advocates direct contact with Nature,—

"Come forth into the light of things,
Let Nature be your teacher."

And again,—

"One impulse from a vernal wood
May teach you more of man,
Of moral evil and of good,
Than all the sages can."

Let me conclude this note by telling you what flowers to expect this month:—"Dancing daffodils," violets dim, "pale primroses that die unmarried," the deep-yellow water-blob, the pensive chequered fritillary, wood anemone or windflower, the wheel-shaped periwinkle, the delicately-tinted wood sorrel, shepherd's purse, lungwort, ground ivy, etc.

* * * * * *

**In the 'Forties—"the Refuse of other Callings."** In these advanced days, when the elementary teaching profession numbers amongst its devotees graduates of various universities and holders of other high diplomas, it is difficult to realise the state of things in the early 'forties. In 1847, Macaulay, in the House of Commons, thus described the schoolmasters of the poor:—

"How many of these men are now the refuse of other callings—discarded servants or ruined tradesmen—who cannot do a sum of three; who would not be able to write a common letter; who do not know whether the earth is a cube or a sphere, and cannot tell whether Jerusalem is in Asia or America; whom no gentleman would trust with the key of his cellar."

This and much more of an interesting nature is to be found in Graham Balfour's book on *The Educational Systems of Great Britain and Ireland*. (H. Frowde, the Clarendon Press, Oxford and London.)

On the question of individual instruction, let me commend this to my readers; it is beautifully Irish:—

"Nowhere was a supply of good school books more wanted than in Ireland. In the old days instruction was almost entirely individual, and every child used to bring with it to school whatever book it could get in which to learn reading. 'It has occurred to a member of the Commission [of 1824] to see in a School in the County of Sligo a child holding the New Testament in its Hands, sitting between Two others, one of whom was supplied with *The Forty Thieves*, and the other with *The Pleasant Art of Money Catching*, while another, at a little Distance, was perusing the *Mutiny Act*, and all reading aloud their respective Volumes at the same Moment.'"

* * * * * *

**Individual Work tells.** There is one general criticism I have often to make upon the work done in infants' schools. It is that there is too little individualising. The teaching, though ever so intelligent, produces very little result. A class is taken as a mass. The answering is often simultaneous. A few sharp ones lead, and the bulk perform the deceptive chorus. You may not cover so much ground if you stop for individuals, but you may be sure that, as far as you go, the results will be more thorough. Give each child, as far as possible, something to do in each lesson. Let children come down in front of the class and ask questions or answer your questions. It is not good for infants to sit still too long.

* * * * * *

**The School Reading-room.** In some schools I find one class-room set apart as a sort of reading-room. Indeed, sometimes there is a little club existing amongst the elder children for the supply of such attractive periodicals as *The Graphic*, *Illustrated London News*, *Boy's Own Paper*, *Harmsworth*, *Strand*, and other magazines. Some boy acts as curator, and the members are admitted before school and during the dinner-hour.

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## ANSWERS TO CORRESPONDENTS.

*S.A.T.*—Let me advise you to postpone the important event at least until after the examination. If, however, you do not take my advice, enter both on the papers. Notify the Education Department in either case.

*G.P.*—The fact that you went to college for one year does not affect the question. Your case is governed by Art. 62—"Teachers who have been examined for the purpose [of raising their certificate] cannot be examined again at the next succeeding examination." You therefore must wait until 1900.

*J.T.*—Yes. I advise you to read and recite again; you will be likely to gain more marks. Write to your inspector.

*E.*—All those desiring to enter the profession other than by apprenticeship are governed by Art. 51 of the Code. I leave out of consideration "women over 18," Art. 68. You do not say what Cambridge examination you have passed. The senior certificate puts you under Art. 51 straight away. London Matriculation also qualifies you as an assistant. After thus entering, you have to obtain the Government certificate in one of two ways—

(*a*) By passing two certificate examinations, or
(*b*) By graduating at a university and obtaining a university teaching diploma in addition.

You would be eligible for a headship only after obtaining a certificate.

*J.B.*—I strongly recommend you to employ an additional teacher. The monitress will count for 20 when she has passed the candidates' examination. Her indentures should be made to run as from July 1. After apprenticeship she will count for 30. Under Art. 74, your temporary monitresses will just save you.

*H.B.*—Yes, certainly; but it will not follow that he will be released from his apprenticeship though he pass. That rests with the managers.

*S.M.*—The only universities granting the B.A. degree without residence are London, the Royal University of Ireland, and Dublin Trinity College. Under the circumstances I advise you to go on with the London course. You need not fear the conversational French if you can get some lessons from a person who can talk the language. If you can afford it, join the U.C.C., and take their self-preparation course.

*Aisn.*—There are three grades in the inspectorate—namely, Her Majesty's Inspector, appointed by the Queen in Council on the nomination of the Lord President; Sub-Inspector, Class 1, appointed by promotion from Grade 2; then there is the Sub-Inspector, Class 2, appointed from amongst certificated teachers with certain qualifications by nomination of the Lord President. There are no Assistant Inspectors now. Write to the Secretary, Education Department, Whitehall, for the memorandum of qualifications for sub-inspectorships. You will find all the required information therein.

*A.B.*—You may classify him as you like.

*Darrigal.*—You can get what you want from Gill and Sons, Warwick Lane, London. I have asked them to write you.

Letters should be addressed—"Inspector," care of The Editor, 33 Paternoster Row. If urgent, two stamps should be enclosed.

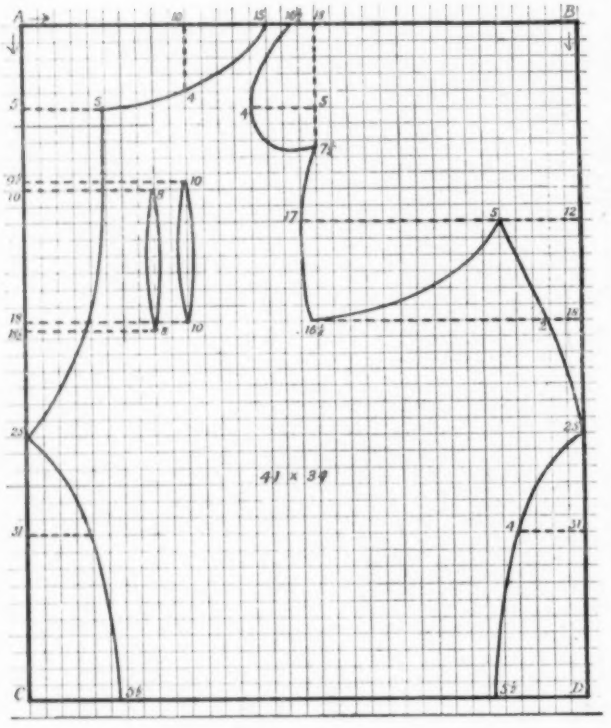
# NEEDLEWORK FOR PRACTICAL TEACHERS.

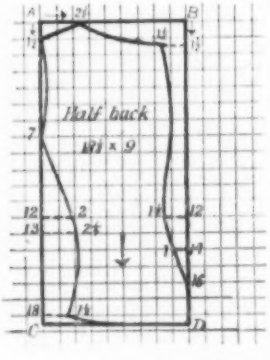
*By the Author of Blackie's "Manual of Needlework."*

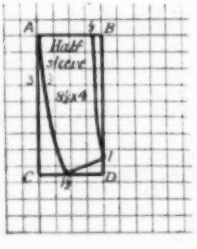
WHILE THESE NOTES ARE WRITTEN SPECIALLY TO MEET THE REQUIREMENTS OF CERTIFICATE CANDIDATES, THEY WILL BE FOUND USEFUL BY ALL TEACHERS WHO HAVE TO PREPARE FOR EXAMINATION IN THIS SUBJECT.

## WOMAN'S COMBINATIONS.

(*Medium Size.*)




How to Make Up the Combinations.

1. *Seams.*

Join the legs of the drawers by sew and fell, or run and fell seam, if of calico, muslin, or flannelette; by a flat herring-bone seam if of flannel. If a flatter seam be desired for calico, then a counter-hem may be substituted.

2. *Kneebands.*

Gather the foot of the legs, with the exception of from 1½ inches to 2 inches on each side of the seam. This is left plain, to prevent the garment from dragging at the knees.

The bands should be from 15 to 17 inches long, and from ¾ to 1 inch wide when finished. The bands may be of plain calico, ornamented with feather-stitching down the centre; of tucked calico (four narrow tucks), with feather-stitching at each side, or of embroidery insertion. A full frill of embroidery or lace may be added; one-third the length of the band or more should be allowed for fullness.

3. *How to finish the upper part of the legs.*

The back part of the legs may be finished with hems ½ inch deep, or cross false hems of the same depth; the fronts are always finished with false hems at least 1 inch deep. These should be hemmed on the *wrong* side, or stitched on the *right* one. These cross false hems must be carried up to the neckband.

4. *Back.*

The two halves of the back of the chemise portion should be joined together either by run and fell, sew and fell, or, preferably, by counter-hemming stitched on the right side.

5. *Side seams of chemise.*

Join the sloping sides of the front to the two sides of the back by a seam corresponding to the centre one on the back.

6. *Darts in fronts.*

Finish the "darts" or side pleats by counter-hemming or run and fell seams.

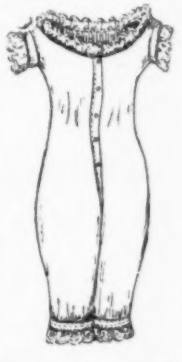
7. *Joining of chemise to drawers.*

Gather and stroke the top parts of the backs of the drawers ¼ of an inch from edge, turn in a fold ¼ of an inch deep along the foot of the back, and, having overlapped the two legs together from 1½ to 3 inches, set in the gathers neatly. Finish the wrong side by a cross false hem or a piece of tape ½ inch wide.

8. *Sleeve and armhole.*

The armhole may be finished by embroidery about 1 inch in depth. Allow half of the *width* round the armhole for fullness. Turn in the edge of the armhole for ⅛ of an inch, and do the same to the raw edge of the embroidery. Lay the one above the other and counter-hem. Feather-stitch round. If a sleeve be inserted, join the seams of the sleeve by a seam corresponding to those used in the garment.

The sleeve should be attached to the body by counter-hemming (the seam of the sleeve being placed 1 inch in front of the side seams), and the outer edge should be finished as described above for the armhole.



9. *Neckband.*

The neckband may be finished by a hem formed from the plain part of the embroidery, or a false hem from ¼ to ½ inch in depth may be put on (the embroidery being inserted between it and the garment). The ends of the neckband should be left *open*, to allow of a casing being inserted, and the tape or ribbon casing should be secured by a row of stitching at the back. From 1½ to 2 yards of embroidery edging will be required for the neckband. Sometimes the *front* has a row of insertion beneath the casing. About 24 inches would be required. Torchon or Valenciennes lace might be used instead of the embroidery.

10. *Buttons and buttonholes.*

The false hems on the fronts are to carry the buttons and buttonholes. Six buttonholes, about 3 inches apart, should be worked on *the right hand facing, across the hem*, and six buttons should be sowed on securely, exactly opposite the buttonholes, on the *left* hand side.

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# SCHOLARSHIP FRENCH FOR 1899. LE TRÉSOR.

BY FRANÇOIS COPPÉE.

LITERAL AND FREE TRANSLATIONS FROM THE ORIGINAL TEXT, WITH NOTES.

*(Authorised by Proprietors of the Copyright.)*

## *LITERAL.*

THE ABBÉ.

Say to-you: "Monsieur Jean!" I!...It (*lit.* that) is inadmissible (=cannot be thought of)!
Are you ("a") duke and ("a") peer?

JEAN, *ridding himself of his equipment of hunting* (=hunting or shooting gear).

I was it (=so), it is possible.
To-day Monsieur Jean is the name which it to-me is necessary (*i.e.* which befits me).
For since that my father is (=has) died (=died) on the scaffold,
And since (that) in exile, and far from the fatherland,
My poor (=dear) Abbé, notwithstanding my title and (my) peerage,
Of (the) bitter poverty I have undergone the lessons,
—For in London in-fine (*or* in short, but better leave untranslated) I have served (the) masons—
Of many (*lit.* well) (of the) vanities I have understood the weakness.

THE ABBÉ.

You do not abjure (*or* renounce) the right of (the) nobility?

JEAN.

No! but I have well enough reflected to know
That each (*lit.* all) right (=privilege) in this world is doubled by a duty (*i.e.* has a corresponding duty).
For (=through) to have (=having) used (of) the one without to fulfil (=fulfilling) the other,
Those who bore * famous names like ours
Are (=have) fallen, and their lamentation is heard in the echo
Of that conqueror (*i.e.* conquering) cannon which comes from Marengo.
Now I, poor emigrant,[1] who, having returned into my country,
Find my property (*pl.*) sold and my solitary roof
Crumbled, and I, who have not, in my sad house,
Anything (of) intact, if it is not that ancient coat of arms;
I who ought henceforward to limit my outlook
To-the three or four fields of corn which I cultivate,
And to ask my life of the (*lit.* to the) labour of my hands—
I make very good marketing (*i.e.* count of little value) all my parchments (*i.e.* deeds, documents),
And I accept my lot bravely, without rebellion.
To my old (=former) vassals (*i.e.* tenants) when I sell my harvest,
When I drink with them the cider of the bargain,
Where then is my peerage? where then is my dukedom?
As far as to (=until) * better times, my friend, I renounce to it.
But as one finds here under the ivy and the bramble
This ducal coat of arms which the ("reign of") Terror spared,
In like ("manner") one finds still in this labourer duke
The most fine legacy that he holds (*i.e.* keeps) of his good origin,
His honour, which survives (to) all his ruin!

THE ABBÉ.

Ah! brave friend... But nothing forbids me
Of-the (*i.e.* at) least to call you always "my dear child."
Is it not ("so"), as at the time of your youth?

JEAN, *to him pressing the hands* (i.e. *pressing his hands*).

Of great heart! (=Gladly; by all means).

THE ABBÉ.

I have for you so much (of) gratitude!
When (=that)—see-there, three months (=three months ago) we are come back (=we came back)
From exile, my niece and I, walking almost bare feet (=barefoot)...

JEAN.

I have received you (=taken you in)... "What of that!" the house is large.

NOTES: **Literal:** –
* Articles, prepositions, etc., that are untranslatable are marked by a *.

## *FREE.*

THE ABBÉ.

Call you "Monsieur Jean!" I?...Impossible!
Are you not a duke and a peer of France?

JEAN, *laying aside his hunting equipment.*

I may have been. But now the name that suits me best is Monsieur Jean.

For, dear Abbé, since my father died on the scaffold, and since, in spite of my title and peerage, while in exile and far from my country, I was schooled in bitter poverty—for in London I worked as a bricklayer's labourer—I have learned the weakness of many vanities.

THE ABBÉ.

But surely you do not renounce your rights as a noble?

JEAN.

No! But I have reflected enough to know that in this world every right has its corresponding duty; and that, through having availed themselves too much of the former without fulfilling the latter, those who bore famous names like ours have fallen, and their lament has been lost in the echo of that conquering cannon which reaches us from Marengo. Now I, a poor *émigré*, who, on returning to my estate, find my property sold and my solitary roof crumbled; I, who possess nothing intact in my gloomy house except this coat of arms; I, who in future must limit my prospects to the three or four fields which I till, and must earn my living by the labour of my hands, think very lightly of all my title-deeds. I accept my lot bravely, and without rebelling against it. And when I sell my crops to my former tenants, and drink a glass of cider with them when we strike a bargain,—where is my peerage then? where is my dukedom then? Until better times come, my friend, I give up these claims. But, just as we find here, under the ivy and bramble, these ducal armorial bearings which the Reign of Terror spared, so there is to be found in this farmer-duke the best of all the legacies he derives from his noble origin,—his honour, which survives whatever else has been ruined.

THE ABBÉ.

Ah, my brave friend! Still, surely there is nothing to prevent *my* at least continuing to call you, "My dear boy," as in your youthful days!

JEAN, *pressing his hand.*

Pray do!

THE ABBÉ.

I do feel so thankful to you! During all these three months since my niece and I came back from exile, trudging along almost barefoot...

JEAN.

I took you in...Well, the house is roomy enough.

[1] Better left untranslated, for *émigré*, here, is one of the royalists, known as *émigrés*, who left France during the Revolution.

## LITERAL.

THE ABBÉ.

And you have taken us all two (=both) at your charge (cost, expense),
You, so poor already...

JEAN.

What fine merit I have!
(The) dry bread is best when it is shared.
—But (the Abbé) in (=with) what object, with so much (of) energy,
Do you examine here my genealogy (*or* pedigree)?
You are preparing then my heraldic tree?

THE ABBÉ.

No, no.
I wish, in-order-to render illustrious for ever your name,
I wish—("a") grander, bolder conception!—
Upon (=about) one of your ancestors to make a tragedy.

JEAN.

I recognize you there (=in that)... Always (*or* still) the old crochet.

THE ABBÉ.

("To") make a tragedy in five acts, in verse.
I of them have already nineteen, quite intact,
Alas! all in verse, and all in five acts,
Which these actors, insolent, heedless ("people"),
Have dared to refuse me...as far as to (*here*, not excepting) my *False Smerdis*,
A masterpiece!—Not matters (=it matters not); they will have but to silence themselves (*i.e.* they will have have to hold their tongues)
This time...It will be in the taste of Voltaire!...
A horrible rascal who has done us an injury!...
But what tragic talent he had, the fellow (*lit.* the animal)!

JEAN.

Thus, in the past of my noble family
You search for a subject?...

THE ABBÉ.

Without doubt. It swarms
With great statesmen, with illustrious generals...
I hesitate only in the choice of the hero.

JEAN, *pointing to* (lit. *showing*) *the bust.*

Take then this-one, the friend of Henry the fourth (*lit.* four)
Whom near-the Ever (*lit.* green, *i.e.* evergreen) Gallant ("for") twenty years (the) one[1] saw fight,
And who died, says one (*i.e.* it is said), of grief and of terror,
In (=on) learning sudden("ly") the murder of-the good king.

THE ABBÉ.

I to-it (=of it) was-thinking. But the king speaks an ignoble language.
*Ventre-saint-gris* is not possible in ("a") noble style.
It is-necessary to give it up (*y* = to it, *renoncer* governs *in*directly).

JEAN, *with a smile.*

It is well damage (=It is a great pity). However...
The son of so-many (of) ancestors for the moment dies of hunger.
Very *à propos* the table is placed (=laid), and invites us.
It is (=will be) mid-day very soon...

## FREE.

THE ABBÉ.

And you, impoverished as you are, have been at the cost of maintaining us both...

JEAN.

A very meritorious act, truly! Dry bread tastes the sweeter when shared with another. But, Abbé, with what motive are you examining my pedigree so sedulously? Are you setting out my genealogy?

THE ABBÉ.

No, no! Mine is a loftier idea. In order to immortalise your name, I wish to write a tragedy, taking one of your ancestors as the hero.

JEAN.

Ah! There I see my old friend riding his favourite hobby.

THE ABBÉ.

A tragedy in five acts, and in verse. I have by me, alas! nineteen already, all in verse and all in five acts, which those insolent, empty-headed actors have refused to perform,—not excepting my masterpiece, *The False Smerdis*. But never mind! This time they will have to hold their criticising tongues. It will be in the style of Voltaire...A terrible rascal, who did us a good deal of harm!...But what tragic talent the fellow had!

JEAN.

So it seems that you are looking for a subject for your play in the past history of my noble family?

THE ABBÉ.

Precisely. It is full of great statesmen and illustrious generals. My one difficulty is the choice of a hero.

JEAN, *pointing to the bust.*

Then take this one, the friend of Henri Quatre. For twenty years he fought by the side of his great master, and it is said he died through grief and horror when he was suddenly told of the murder of the good king.

THE ABBÉ.

I had the same idea. But the king speaks in such an ignoble way. You cannot use such an expression as *Ventre-saint-gris* in a dignified composition. No, it will not do!

JEAN, *with a smile.*

It is a pity. However, the scion of this ancient house is just now dying of hunger. And the table, which is laid very *à propos*, invites us to sit down. It is nearly noon.

---

NOTES: **Literal**:—
[1] *On* with its verb may often be best translated into English by the verb "to be" and the participle—"was seen fighting," "was seen to fight."=*Un homme*, "man."


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# OUR TUTORIAL SECTION

## OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

*Head-Master of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of "Scholarship School Management."*

### SPRING EXAMINATION, 1899.

### Twelfth Month—March.

WORK TO BE PREPARED.

#### A.—*English.*

*All Years.*—Revise or finish revision of the special books set, and the prefixes, affixes, etc., prescribed in the syllabus. The notes on paraphrasing, analysis, and parsing given in these columns should be of use; all knotty points which have been met with should be once again referred to, and the exact meanings of all allusions learned.

If you are asked to explain references, it is frequently necessary to give (1) a literal, historical, or etymological explanation, and then (2) the application in reference to the context. Thus in a recent examination the question was asked: "Explain—

'Revere his consort's faith, his father's fame,
And spare the meek usurper's holy head.'"

This should be given thus:—

1. *His consort's faith.* His consort was Margaret of Anjou, and the "faith" referred to is the persistency with which she upheld the Lancastrian cause in spite of overwhelming disasters.

2. *His father's fame.* Henry the Fifth is here referred to, who was endeared to all Englishmen by his brilliant victory at Agincourt and his successful campaign in France.

3. *The meek usurper.* Henry the Sixth, who was more fitted for the cloister than the throne, especially in such a troublesome time. The term "usurper" is hardly correct as applied to him, as he was the third in direct descent of kings, and Henry the Fourth was elected to the throne at a time when the right of primogeniture was not laid down by law.

4. The *general meaning* is a request that Henry the Sixth may be spared from the effect of the curse on account of the glory of his father, Henry the Fifth, and the steadfast loyalty of his wife, Margaret of Anjou.

Or again: "Explain—

'The hollow-sounding bittern.'"

1. The bittern is a shy bird. Its cry is a deep sound, which has gained for it the epithet of "booming." It was formerly believed that "the bird sounded its deep note by thrusting its beak into soft, marshy ground, and in that position uttering its cry."

2. The idea is introduced here with considerable effect to convey the idea of the desolation which had come over a once populous village.

In spite of the many times that errors in methods of parsing and analysis have been pointed out, they still are very numerous. The following rules must be observed:—

1. *In parsing.* Give (1) the part of speech, (2) the class, (3) the various inflections, if any, and (4) the syntactical relation of the word. The last *must not be* omitted, as frequently happens, especially with participles and infinitives. No abbreviations of less than three letters are allowed. The following is a model which should be followed:—*Auburn.* Noun, prop., sing. num., 2nd pers., neut. gend., nom. case of address. State exactly what conjunctions join, and the relation shown by prepositions. Remember that *only* transitive verbs have voice.

2. *In analysis.* The following columns must be used:—(1) sentence, (2) kind, (3) connecting word, (4) subject, (5) enlargement of subject, (6) predicate, (7) extension of predicate, (8) object, (9) enlargement of object. The various kinds of extension of the predicate should be specified as time, place, manner, etc. The relations of the various kinds of sentences should be stated fully—not merely "subordinate," but "subordinate" to No. 1 and "adjectival" to some particular word of which it is an enlargement.

In reading up the lives of the authors you have studied, you should try to find out what particular qualities in their writings have made them attain the rank they possess, and be able to discuss their style.

Thus, Gray wrote but little, yet what he produced obtained more fame for him than voluminous works have for many other authors. This is because his classical education made him fastidious, and his poems were elaborated and polished with unremitting care until they became perfect. The stately roll of the *Elegy*, combined with its serious line of thought, has made it one of the best-known poems in the world.

Third year pupil teachers will have found some difficulty with Pope's *Essay on Man*, and the following brief notes should be carefully digested:—

1. Pope was largely inspired by Bolingbroke. The subject of man's place in creation, his end and aim, has always been a controversial subject. Pope boasts of "having tempered the one by the other, and of having steered between extremes." As a matter of fact, he did not know enough of his subject to produce an original treatise, and he has only succeeded in mixing together incompatible ideas. With the metaphysical quibbles of the work the student has little to do, although he should read up the analysis of the contents which is prefixed to each essay.

2. It is as literature rather than as a didactic poem that it is now read. Mallett, a friend of Pope, is said to have told him (before the authorship was confessed) that it was "shocking poetry, insufferable philosophy, no coherence, no connection." On the first point he was wrong, on the others probably right. As a versifier Pope was without an equal, and when he forgets his philosophy, and puts down simple truths in the beautiful language at his command, he stands forth as a poet of the first rank.

"Scarcely any one, till a controversy was raised, thought of the doctrines; but a thousand must have been warmed by the pictures, the addresses, the sublime interspersions of description, and the nice and harmonious precision of every word, and of almost every line. Whether, as a system of philosophy, it inculcated fate or not, no one paused to inquire; but every eye read a thousand times, and every lip, perhaps, repeated, 'Lo, the poor Indian,' etc.; 'The lambs they riot,' etc.; 'Oh happiness,' etc., and many other passages. All these illustrative and secondary images are painted from the source of genuine poetry, from nature and not from art. They, therefore, independent of powers displayed in the versification, raise the *Essay on Man*, considered in the abstract, into genuine poetry, although the poetical part is subservient to the philosophical."—BOWLES.

3. The metre throughout is the Iambic pentameter in rhyming couplets, the commonest form of poetry at that period. The lines scan thus:—

Oh hap | pi-ness | our be | ing's end | and aim |

Good pleas | ure ease | con-tent | what-e'er | thy name |

4. Pope sometimes sacrifices truth for the sake of antithesis: for example, of Bacon, "The wisest, brightest, meanest of mankind"—"meanest" is decidedly incorrect; or for the sake of alliteration: for example, "Macedonia's madman"—hardly a good term for Alexander the Great, unless all genius be a form of madness.

#### B.—*Arithmetic.*

Study of and practice in the solution of problems bearing on the year's work.

Attention must once again be called to the great importance of methodical arrangement and adequate verbal explanations. Correctness is really of less importance than these points. Revise all theory, and learn definitions of all terms employed.

First year pupil teachers must pay great attention to the theory of G.C.M. and L.C.M. A very frequent question is, Find the G.C.M. of two numbers, and *prove* that it is the G.C.M. To do this, divide both numbers by the G.C.M.: if there is no remainder, this proves that it is a common measure. Then take the quotients: if these are prime numbers, or prime to each other, it follows that they have no common factor, and hence the original divisor is the *greatest* common factor.

To prove the various operations with fractions by means of diagrams is another common question. The theory of ratio and proportion must also receive attention. Look up the various terms used: ratio, proportion, inverse ratio, antecedent and consequent, compound ratio, duplicate and triplicate ratio, and the various equalities which may be deduced from the statement, "As A : B :: C : D."

Recurring decimals, and the rule for converting them to vulgar fractions, form another favourite topic. If asked to *prove* the latter, a particular example will do. Thus:—

To find a vulgar fraction = $\cdot\dot{2}3\dot{4}5$

Let F = the fraction required.

Then F = $\cdot 2345454545$ to infinity.

And $*10000\ F = 2345{\cdot}45454545$ "

And $\dagger 100\ F = 23{\cdot}45454545$ "

Subtract, $9900\ F = 2345 - 23$

or $F = \frac{2345 - 23}{9900}$

Hence the rule: From the whole number deduct the non-repeating figures; for the numerator take as many 9's as there are repeating figures, and as many 0's as non-recurring figures for the denominator.

* Multiply by a sufficiently high power of ten to carry all digits over the decimal.

† Multiply by a power of ten to carry non-repeating figures over decimal point.

*Note on the Metric System of Weights and Measures.*—The formation of the metric system is due to the zeal for reform displayed by the French after the great Revolution, when they endeavoured to blot out the past as far as possible and start with everything new, even to the date and the calendar. Among the innovations, many of which were found to be unworkable, a complete and scientific system of weights and measures was devised and introduced in 1799, the subsequent popularity of which is sufficient evidence of its practical utility.

Where the weights and measures have been gradually evolved, as in England, the terms employed and the quantities they express have little or no natural relation, and hence the difficulty experienced by teachers in dealing with this branch of arithmetic. To take a few instances, the *inch* was originally the breadth of

the thumb, the *foot* the length of Charlemagne's foot, the *yard* the length of an arm; the *hand* and the *span* explain themselves. Not only is there no natural relation in the weights and measures employed, but the same term has various meanings—thus, the hogshead of ale is nominally 54 gallons; of claret, 46; of port, 57; of sherry, 54; of Madeira, 46.

In the metric system these anomalies are abolished, and on that account the system has been adopted in nearly every civilised country but our own. The advantages are fully recognised in England, but the great objection is the cost which a change would entail, but this would probably be more than compensated for in convenience and increase of trade.

The founders of the metric system, to obtain a standard measurement, took one ten-millionth part of a quarter of the earth's circumference—that is, the distance from the equator to the poles. This, obtained by triangulation, gave a length of 39·3708 inches, which was called the *metre* (Gk. *metron*, a measure). It was subdivided into tenths, hundredths, and thousandths, and multiplied by ten, hundred, thousand for other dimensions; so that the table of linear measurement is—

10 millimetres = 1 centimetre.
10 centimetres = 1 decimetre.
10 decimetres = 1 metre.
10 metres = 1 decametre.
10 decametres = 1 hectometre.
10 hectometres = 1 kilometre.
10 kilometres = 1 myriametre.

It will be observed that the Latin prefixes *milli-*, *centi-*, *deci-* are used for submultiples, and the Greek prefixes *deca-*, *hecto-*, *kilo-*, *myri-* for multiples. This method is adopted for all other tables.

From the linear measure all other weights and measures are obtained, as will be seen from the following table, which should be committed to memory:—

| Table. | Unit. | English Equivalent. | How obtained. |
|---|---|---|---|
| Length | Metre | 39·3708 inches | One ten-millionth part of a quarter of the earth's circumference. |
| Area | Are | 1076·429 sq. ft. | 100 square metres (sq. decametre). |
| Capacity | Litre | 1·76 pints | Cubic decimetre. |
| Solidity | Stere | 35·3165 cub. ft. | Cubic metre. |
| Weight | Gramme | ·032 oz. Troy | Weight of a cubic centimetre of water at a given temperature. |

The advantages of such a system are obvious. Since the quantities increase by 10's, and 10 is the scale of notation we employ, there are no compound rules, and reduction may be done at sight. For example, reduce 7 kilom. 6 hectom. 7 decam. 3 metres 7 decim. 8 centim. 9 millim. to millimetres = 7673789: to metres = 7673·789, etc. Or, to take another example, multiply 1 kilog. 7 hectog. 8 decag. 5 gram. 8 decig. by 121. This equals 17858 decig. × 121 = 2160818 decig. = 216 kilog. 0 hectog. 8 decag. 1 gram. 8 decig.

Another example—7 hectol. 3 decal. 5 litres 3 decil. 8 centil. at 12 fr. 75 cent. per litre. This is 735·38 litres at 12.75 francs per litre. By ordinary multiplication this is 9376.095 francs, or 9376 francs 9·5 centimes.

*Decimal Coinage.*—The decimal system of coinage advocated for England is 10 mils = 1 cent, 10 cents = 1 florin, 10 florins = £1. Thus a *cent*, or the $\frac{1}{100}$ of the £, would be about 2½d., the *mil* about ¼d. A 5-mil piece would be roughly the same value as a penny, and a 5-cent piece as a shilling.

Many valuable suggestions have been made to simplify the change, which, though somewhat puzzling at the time, would be readily and easily adopted. It would be advisable to work a few examples in these weights and measures. No difficulty should be found. If any is experienced, write for assistance.

## C.—*Geography.*

Revise Asia. Practise memory maps regularly. Remember that the map obtains more than one-third of the marks given for the paper. Tabulate answers where possible. Condense as much as possible. Put down *facts*, not *generalities*.

If asked to "say what you can about a country," arrange your answer under: (1) physical features, (2) climate, (3) productions, (4) industries, imports and exports, (5) people, (6) chief towns, (7) government, education, religion, history, etc. You may not be able to write much about each—in fact, you will not have time—but some such arrangement will prevent wandering and repetition. Similarly with such a question (a common type) as, "What do you know of the industries of France?" classify under such heads as (1) agriculture, (2) manufactures, (3) mining, (4) pastoral, (5) shipbuilding, (6) fishing, etc.

In revising Asia, pay attention to Chinese affairs, French influence and colonies in the Indo-Chinese Peninsula, Afghanistan, the Trans-Siberian Railway. Remember that the syllabus says, "with special reference to India." See notes on India in last month's PRACTICAL TEACHER.

## D.—*History.*

Finish revision 1603–1689. A most important period, especially with regard to constitutional advance. All the chief points have been given previously.

### *Selected Questions on the Stuart Period.*

1. State the causes which led to the execution of the Earl of Strafford.
2. Describe shortly Oliver Cromwell's relations with foreign powers.
3. Give a short account of the reign of James the First. How did the growing power of the Commons manifest itself in this reign?
4. Say what you can about *two* of the following:—Edward Hyde, Robert Cecil, Prince Rupert, Pym, Argyle, Algernon Sydney.
5. Explain the following:—Tonnage and Poundage, Grand Remonstrance, Roundheads, Attainder, Restoration.
6. Write what you know of the disputes between King and Parliament in the reigns of Charles the Second and James the Second.
7. What beneficial results may be traced to (1) the Black Death, (2) the Great Fire of 1666?
8. Describe briefly the events which led to the Restoration.
9. By what means did Charles the First raise money without the aid of Parliament?
10. Write a short life and character of either Lord Chancellor Bacon, or Monk Duke of Albemarle.
11. What was the Self-Denying Ordinance, and what was its effect?
12. What were the circumstances immediately preceding the outbreak of civil war in 1642? Trace the general course of the war to the year 1645.
13. Say what you can of *two* of the following:—Duke of Buckingham (died 1629), Milton, Shaftesbury, Burleigh, and Penn.
14. Explain the following terms in English History:—The Star Chamber, the Covenant, Ironsides, the Cabal, Habeas Corpus.
15. What were the chief causes which led to the Revolution of 1688?
16. What was Ship Money? Explain Hampden's objection to pay it.
17. What was the Test Act, and when was it passed?
18. What statutes are comprised under the Clarendon Code?
19. What industries do we owe to any foreign emigrants, and what cause led these foreigners to leave their own lands?
20. Describe Monmouth's insurrection and its suppression.
21. Explain what is meant by Divine Right of Kings and Passive Obedience.
22. Give some account of the Dutch wars in the period you have studied.
23. What was the Navigation Act? Why was it passed, and what were its effects?

## E.—*Euclid.*

Finish all revision, and continue working of deductions. Practise writing out problems in a given time, say 15 minutes. Make sure of such questions as the following:—(1.) What is a corollary? Write out the corollaries in Book I. (2.) What are converse propositions? Point out the converse propositions in Book I. (3.) Write out the enunciations of propositions which deal with equality of triangles. (4.) Explain hypothesis, problem, theorem, Q.E.D., Q.E.F., axiom, postulates, etc.

## F. and G.—*Algebra and Mensuration.*

Continue practice with any test papers or previous questions.

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*For test questions work the following test examination.*

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## FINAL TEST EXAMINATION.

Papers should be worked under strict examination rules. If desired, the papers will be marked and criticised if sent to Mr. A. T. Flux, Belvedere, Kent, together with P.O. for 1s. 6d.

### *All Years.*

**1.** *Penmanship* (**10** *min.* **40** *marks*).

Write as specimen of copy-setting:—
(*a*) Large Hand—*French Huguenots.*
(*b*) Small Hand—*Edward Hyde, Earl of Clarendon, wrote the History of the Great Rebellion.*

**2.** *Geography* (**1** *hour.* **80** *marks*).

(Answer Question 1, and two others.)

1. Draw a map of Italy, marking and naming the chief river mouths and ports, and the positions of Florence, Padua, Pavia, Milan, Turin, Palermo, and Perugia.
2. Describe briefly the course of *two* of the following:—Rhine, Rhone, Ganges, Yang-tse-kiang.
3. Describe the physical features of the Indo-Chinese Peninsula. What countries are comprised in it? Mention their chief towns.
4. Write what you know about *three* of the following:—Scinde, Tinnevelly, Simla, Plassey, Delhi, the Great Indian Desert.
5. Describe a coasting voyage from Marseilles to Venice.
6. How is the climate of Southern Europe affected by the Mediterranean, and that of India by the monsoons?

**3.** *History* (**1** *hour.* **80** *marks*).

(Answer *three* questions, including the first, if you can.)

1. What do you consider the three most noteworthy events in the fourteenth century, and why?
2. Say what you can of Henry the Fifth's campaign in France.

3. What circumstances led to the meeting called "The Field of the Cloth of Gold"?
4. Give a summary of what occurred between Oliver Cromwell's death and the return of Charles the First.
5. What do you know of *two* of the following:—Thomas Cromwell, Wentworth, Knox, Drake, Jeffreys?
6. Compare the Constitution of England in 1485 with the Constitution in 1688.

### *First Year.*

*English* (1 *hour.* 80 *marks*).

(Answer Question 1, and *two* others.)

1. Analyse the following:—
   (*a*) *Methinks* I hear, in accents low,
   The sportive *kind reply*,
   Poor *moralist!* and what art thou?
   (*b*) In *you* bright track *that* fires the western skies
   They melt, they vanish from my eyes.
   (*c*) And distant warblings lessen on my ear,
   That *lost* in long futurity expire.
2. Parse the words in italics.
3. Explain briefly and clearly the following:—
   (*a*) You sanguine cloud raised by thy breath.
   (*b*) Half of thy heart.
   (*c*) The Attic warbler pours her throat.
   (*d*) Some show their gaily-gilded trim.
4. Explain the use and meaning of the suffixes in the following words:—*fondly, restful, penniless, strongest, golden, princess, duckling, width, rivulet, seam.*
5. Write sentences containing (*a*) an adverbial phrase, (*b*) a demonstrative adjective, (*c*) an infinitive of purpose, (*d*) a gerund.
6. Write a life of Gray, and point out the chief characteristics of his writings.

*Arithmetic* (1 *hour.* 100 *marks*).

(Answer Question 1, if you can, and *two* others.)

*Boys.*

1. What is a factor? When are numbers said to be (*a*) prime, (*b*) prime to each other? Divide 32547631 by successive division by the prime factors of 1155, and show how to obtain the complete remainder.
2. Express in their simplest forms—

$$(a)\ 3\tfrac{1}{3} \div \left\{\frac{1-1\frac{5}{12}}{\frac{1}{2}-\frac{1}{5}}\right\}; \qquad (b)\ \frac{\frac{3}{5}\text{ of }1\frac{2}{3}\text{ of }2\frac{1}{2}}{\frac{2}{5}+1\frac{3}{10}-\frac{3}{4}}.$$

3. What would it cost to pave a hall 50 yards long by 50 feet broad with marble slabs 1 foot long and 9 inches broad, the price of the slabs being £5 per dozen?
4. A man who owned $\frac{1}{17}$ of a business sold $\frac{3}{25}$ of his share for £$1\frac{8}{10}$. What would be the value of $\frac{\frac{3}{5}}{4\frac{1}{4}}$ of $\frac{1}{8}$ of the whole business?
5. (*a*) What decimal multiplied by $\frac{1}{7}$ will equal the sum of $11\frac{1}{330}$ and $\frac{1}{110}\frac{1}{33}$?
   (*b*) Simplify $\dfrac{2{\cdot}791\dot{6} \times 3{\cdot}2\dot{3}\dot{7}}{1{\cdot}861 \times {\cdot}809\dot{3}\frac{1}{4}}$.

*Girls.*

1. Define multiple, common multiple, least common multiple. Show that if a number measures another, it measures any multiple of it.

A certain event is known to happen at regular intervals. It is observed to take place after an interval of 22 days 11 hours 15 minutes 3 seconds, and again after an interval of 12 days, 20 hours 8 minutes 36 seconds. What is the greatest possible interval at which the event happens?

2. Find the cost of fencing 3 miles 3 furlongs 180 yards 1 foot 6 inches of road at £479, 15s. per mile.
3. Make out a bill for the following:—43 yards tapestry carpet, at 3s. 5d. per yard; 25½ yards cocoa-nut matting, at 2s. 10d. per yard; 17¾ yards linoleum, at 3s. 9d. per yard; 3 rugs, at 5s. 11d., 12s. 9d., 15s. 3d. each.
4. Simplify (*a*) $9 - \frac{5}{8} - 2\frac{5}{12} + \frac{7}{15}$; (*b*) $1\frac{3}{11} - \frac{4}{33} - \frac{7}{165}$.
5. One man takes 120 steps a minute, each 30 inches long; another walks 3½ miles an hour. If they start together, how soon will one of them be 100 yards ahead of the other?

*Music* (15 *min.* 15 *marks*).

(Answer *three* questions.)

1. State which tones of the scale have above them (*a*) minor third, (*b*) major sevenths.
2. Rewrite the following in two-pulse measure, halving the value of each note and rest:—

| d :- | - :m | s :- | :f | m :- | : ‖

3. What are the mental effects of *me, fah, lah, te*? How are mental effects modified?

### *Second Year.*

*English* (1 *hour.* 80 *marks*).

(Answer Question 1, and *two* others.)

1. Paraphrase:—
   Thus *to relieve* the *wretched* was his pride,
   And *e'en* his failings leaned to virtue's side;
   But in his duty prompt at *every* call,
   He watched and wept, he prayed and felt for all;
   And *as* a bird each fond endearment tries
   *To tempt* its new-fledged offspring to the skies,
   He tried each art, reproved each dull delay,
   Allured to brighter worlds, and led the way.
2. Analyse the above, and parse words in italics.
3. Write brief and clear explanations of the following:—Torno's cliffs, wild Altana, bats in drowsy clusters cling, the laboured mole, terms and tides presage.
4. Explain the meaning of the prefixes in the following:—Indirect, circumlocution, respond, predetermine, co-operate, deduct, pellucid, absolve, prevail.
5. What is meant by inflection? Give some examples, and show how the want of inflections is sometimes supplied.
6. Write a life of Goldsmith, and mention his chief works.

*Arithmetic* (1 *hour.* 100 *marks*).

(Answer Question 1, and *two* others.)

1. If 317 be the G.C.M. of three numbers, and the other factors of each are 57, 209, 231, what is the L.C.M. of the numbers?

Four numbers have one factor in common, and there is no other factor which is common to any two of them. Their product is 65975910, and their L.C.M. is 30030. What is their common factor?

2. A reduction of 20 per cent. in the price of beef would enable a purchaser to obtain 6 lb. more for a sovereign. What is the reduced price?
3. What sum must I invest in the 3 per cents. at 87¾ so that my income may be the same as that derived from £819 in the 4½ per cents. at 93¾, an income-tax of 8d. in the £ being deducted from the latter?
4. If A and B can do a piece of work in 6½ days, and A can do in 3½ days as much as B can do in 5, how long will each take to do it singly?
5. At what rate per cent. simple interest will £1560 increase in $\frac{5}{12}$ years to £1805, 14s.? What would be the *time*, supposing the *rate* to be 2 per cent.?

*Girls.*—As First Year Boys.

*Euclid* (40 *min.* 50 *marks*).

(Answer *two* questions.)

*Boys.*

1. Prove I. 4.
2. At a given point in a given straight line to make a rectilineal angle equal to a given rectilineal angle.
3. Describe an isosceles triangle, having given the base and the length of the perpendicular drawn from the vertex to the base.

*Teaching* (40 *min.* 40 *marks*).

(Answer *two* questions.)

1. In choosing a *style* of writing, by what considerations would you be influenced?
2. What is the use of "word-building"? Give an outline of a lesson to Standard V.
3. Give as many forms of mental exercise as you can contrive on the number 24.

*Music* (15 *min.* 15 *marks*).

(Answer *three* questions.)

1. Rewrite the following passage without change of key:—

d m l ˡd m r s l t dˡ s m f ʳs m d

2. Write the following intervals:—

   Perfect fifth above r
   Major third ,, m
   Minor third ,, f
   Major sixth ,, s
   Perfect fourth ,, l

3. Rewrite the following in two-pulse measure, halving the value of each note and rest:—

| d :m | r :-.f | s.m:r.d | m :f | s :-.f | l :t | dˡ :- | : ‖

### *Third Year.*

*English* (1 *hour.* 80 *marks*).

(Answer Question 1, and *two* others.)

1. Paraphrase:—
   Know then this truth, *enough* for man *to know*,
   Virtue *alone* is happiness below;

The only point where human bliss stands still
And tastes the good without the fall to ill;
Where only merit constant pay receives,
Is blest in *what* it takes and what it gives;
The *joy* unequalled if its end it *gain*,
And if it lose, attended with no pain;
Without satiety, tho' *e'er so* blessed,
And but more relished as *the more* distressed.

2. Analyse the above, and parse words in italics.
3. Explain clearly and briefly the following:—leather or prunella; Macedonia's madman; Marcellus exiled; the Rubicon; whatever is, is right.
4. Give the etymology of the following words, and use each in a sentence:—abstract, circumstance, compassion, circumspective, benevolence, philosopher.
5. Give in your own words a summary of what Pope considers the cause of happiness.

*Arithmetic* (1 *hour*. 100 *marks*).

(Answer *three* questions.)

*Boys.*

1. A grocer bought 500 lbs. of tea, and sold 100 lbs. at 2s. 3d. per lb., making a profit of 12½ per cent. At what rate per lb. must he sell the remainder so that he may gain 20 per cent. on the whole purchase?

2. Find to 5 places of decimals the value of

$$\frac{\sqrt{3}-\sqrt{5}}{\sqrt{5}+\sqrt{3}}.$$

3. A rectangular field, which is twice as long as it is wide, costs 1·0138 shillings per square yard to turf. If the whole cost is £191, 17s. 0½d., find the dimensions of the field.

4. Determine the difference between the true and bankers' discount on £2500, payable 6¼ years hence, simple interest at 4 per cent. per annum.

5. Simplify

$$\frac{3\cdot\dot{5}\dot{7}\dot{6}+2\cdot4\dot{2}\dot{3}+2\cdot0\dot{0}0\dot{1}9\dot{1}\dot{1}}{\cdot\dot{5}7\dot{1}4\dot{2}8\dot{5}} \div \frac{\cdot004}{\cdot\dot{3}\dot{6}\times\cdot0005}.$$

*Girls.*

1. Pipes A and B can fill a cistern in 3 minutes and 5 minutes respectively, and C can empty it in 7½ minutes. In what time will the cistern be filled if all are open?

2. A goods train is 8 miles ahead of an express which travels at the rate of a mile in 1½ minutes. It is run into in 20 minutes. What was the rate of the goods train?

3. Multiply 2·47 by 2·0047; and divide 4·010305 by ·000725 to 5 places of decimal.

4. Raising the income-tax 1d. in the £ increases the amount of tax by £2, 3s. 4d., and the tax I actually pay is £15, 3s. 4d. What is the rate of the income-tax?

5. Add together ⅔ of £5, 3s. 4d., ⅓ of £1, 16s. 5d., and ⅝ of £11, 0s. 3½d.

*Euclid and Algebra* (1 *hour*. 100 *marks*).

(Answer *two* questions in each.)

1. If two adjacent sides of a quadrilateral are equal, and the angle contained by them is bisected by a diagonal, show that the other two sides are also equal, and that the angle contained by them is bisected by the same diagonal.

2. To bisect a straight line—that is, to divide it into two equal parts.

3. Prove I. 24.

1. (*a*) How do you show that $x^p \times x^q = x^{p+q}$ when $p$ and $q$ are integers?

(*b*) Find the G.C.M. of $x^{2p}-1$, and $x^{3p}-1$.

2. Solve—

(*a*) $$\frac{7}{x-4}-\frac{5}{x+3}=\frac{2}{x-5}.$$

(*b*) $$\frac{b}{x-a}+\frac{a}{x-b}=\frac{a+b}{x}.$$

3. If 352 persons give each as many pence as the cost of collection comes to in shillings, and the charity thus receives £12, 15s., how much does each give?

*Teaching* (40 *min*. 40 *marks*).

(Answer Question 1, and *one* other.)

1. Write notes of a lesson on one of the following subjects:—
   (*a*) Danger of throwing stones.
   (*b*) Transformations of an insect.
   (*c*) The coast of China.
   (*d*) The Romans in England.
2. What are the objects to be aimed at in the teaching of English?
3. What do you consider the most important topics in teaching the geography of a country?
4. By what means would you endeavour to make yourself acquainted with the characters of the children in your class?

*Music* (15 *min*. 15 *marks*).

(Answer *three* questions.)

1. From the following passage select pair of notes which illustrate (*a*) augmented second, (*b*) diminished seventh, (*c*) augmented fifth:—

**d re m f s l t d' de' r'**

2. Which of the following notes is highest and which lowest:—
*ray*$_1$ in Key C, *lah* in Key G, *fah*$_1$ in Key F, *me*$_1$ in Key B♭, *soh*$_1$ in Key D?

3. Write out the following passage in three-pulse measure. Begin on a strong pulse. The figures indicate pulses, or fractions of a pulse:—

1 ⅓ ⅓ ⅓ 1 1 ½ ½ ¾ ¼ 1 1 ½ ½ ½ ¼ ¼ ½ ½ ½ ½

**s s f m f r d r m s f m** rest **d' s r m f t**$_1$ **d** rest.

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## AUTUMN EXAMINATION, 1899.

### Sixth Month—March.

WORK TO BE PREPARED.

A.—*English.*

*First Year.*—Prepare *Ode on the Spring*, verse 1.

*Second Year.*—Prepare fully lines 217–250 of *The Deserted Village*.

*Third Year.*—1. Learn twenty roots and meanings each week.
2. Prepare lines 205–240 of Pope's *Essay on Man*, Epis. IV.

**(For Full Notes on Paraphrase, Parsing, and Analysis, see October Number, 1898.)**

B.—*Arithmetic.*

*First Year.*

*Boys.*—Addition, Subtraction, Multiplication, and Division of Recurring Decimals. (Note method of performing operations without reduction to fractions.)

*Girls.*—Problems on Fractions.

*Second Year.*

*Boys.*—Stocks.

*Girls.*—General problems or back questions.

*Third Year.*—Work any general papers.

C.—*Music.*

A set of questions should be worked each week.

D.—*Geography.*

*Asia.*—Physical features, climate, productions, and peoples.

Draw a large blank map. Go round the coast, fill in all names to be remembered, and learn them off. Then fill in mountains and rivers. Notice the slopes of the surface, and their influence on climate. The climate largely controls the productions, which must be carefully tabulated and learned. Note the great divisions of the people.

E.—*History.*

James the First and Charles the First to the outbreak of the civil war.

The greatest attention must be given to the rise of power of the House of Commons, the influence of the Puritans and other religious sects, and the Stuart theories of Divine Right of Kings.

F.—*Euclid.*

*Second Year.*—Props. 17–20, Book I. Three deductions per week.

*Third Year.*—Book I. Revise Definitions, Axioms, and Postulates, and Definitions and Props. 1–6, with six deductions per week.

G.—*Algebra.*

Problems on Simple Equations.

H.—*Teaching.*

*Second Year.*—Chap. vi., *Scholarship School Management*.

*Third Year.*—Thrift, School Libraries, Object Lessons. Read up what is said about each in Revised Instructions to Inspectors.

*Test Questions.*

1. Penmanship.

Large Hand:—*Tanganyika.*
Small Hand:—*'Tis better to have loved and lost*
*Than never to have loved at all.*

2. Paraphrase and analyse all English set, and parse any words presenting difficulty.

3. Explain clearly what states are comprised in the Balkan Peninsula. Give their chief towns.

4. Describe a coasting voyage from Corinth to Constantinople.

5. Explain the circumstances which led to the coming of the Armada.

6. Give some account of the condition of the poor in Tudor times. What laws were passed with regard to them?

7. (*a*) **Explain the uses of mental arithmetic, and form as many exercises as you can with the number 24.**
(*b*) **What do you understand by a good tone in a school?**

## SCHOLARSHIP COURSE FOR DECEMBER 1899.

1. *Reading.*—Ten minutes' practice per diem, as often as possible before a competent critic. Take at least one of Scott's novels per month.

2. *Writing.*—Five or ten minutes' daily practice, with continual care at all times. (Use the *Pupil Teachers' and Scholarship Copy Book.* Office of the P.T., 1s.)

3. *Repetition.*—Twelve lines weekly till thoroughly known. Oral dramatic recitation necessary.

4. *Composition.*—Continual care and practice needed. Send up an essay each month for criticism. Write one or two essays each week, selecting from the following subjects:—Thrift; The Study of Natural History; The Value of Time; Westminster Abbey; Birds and Insects as Friends of Man; Progress during the Present Reign; Free Libraries; The British Constitution. Read up your subject if necessary; arrange your ideas; write and rewrite your essay until you have polished it to the best of your ability.

5. *English Language and Literature.*

(1.) Learn twenty roots and meanings each week.

(2.) Prepare the grammar of the pronoun. Prepare a good classification. Note the etymology of the personal and demonstrative pronouns.

(3.) *Literature:* Pp. 71–116 of Collier's *English Literature.* *Chief Topics:* Caxton and the Early Printers; More and his *Utopia*; Tyndal; Cranmer; Earl of Surrey; Skelton; Udall; Ascham; Buchanan.

The interest of this period lies not so much in the writers and their books as in the inception of new ideas and method, in the gradual crystallising of English into its present form. It is the connecting link between the Dark Ages of superstition, ignorance, and manuscript and the flood of light, learning, and printed books characteristic of the Elizabethan period. To trace the influence of printing, of the revival of learning, of the great religious controversy, of the disappearance of the old Mystery and Miracle Play and the rise of the drama, is a step which must be taken to understand fully the remarkable development of thought which followed.

(4.) Prepare lines 250–500 of Cowper's *Task*, Bk. IV. (Write for assistance in difficulty.)

6. *Arithmetic.*—Christian and Collar: The Metric System, Practice, Ratio, and Proportion. It will not, of course, be necessary to work all the examples given. The metric system must be thoroughly mastered, and the theory of ratio and proportion understood. Sums should be worked by both method of unity and proportion. Select those sums which are likely to present difficulty, and write for solutions where necessary.

Solutions requested.

*Ex. 55, No. 3.*—Simplify

$$\frac{\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}+3\times\frac{2}{3}\times\frac{2}{3}\times\frac{1}{3}+3\times\frac{2}{3}\times\frac{1}{3}\times\frac{1}{3}+\frac{1}{3}\times\frac{1}{3}\times\frac{1}{3}}{\frac{2}{3}\times\frac{2}{3}+2\frac{1}{3}\times\frac{1}{3}+\frac{1}{3}\times\frac{1}{3}}$$

$$=\frac{(\frac{2}{3})^3+3(\frac{2}{3})^2(\frac{1}{3})+3(\frac{2}{3})(\frac{1}{3})^2+(\frac{1}{3})^3}{(\frac{2}{3})^2+2(\frac{2}{3})(\frac{1}{3})+(\frac{1}{3})^2}$$

$$=\frac{(\frac{2}{3}+\frac{1}{3})^3}{(\frac{2}{3}+\frac{1}{3})^2}=\frac{3}{3}+\frac{1}{3}=\underline{1\tfrac{1}{3}}.$$

(This is only solved simply by applying algebraic formula.)

*Ex. 75, No. 9.*—The difficulty experienced in this sum is the result of thinking that $\frac{19s.\ 3d.}{539d.}$ = so many *pence*. Remember that concrete quantities divided by concrete quantities = *abstract* number. Hence the two fractions can be added.

7. *Algebra.*—Hall and Knight, chaps. xx. and xxi. L.C.M. and Addition and Subtraction of Fractions. Note carefully Ex. 21 (*c*) and 30 (*e*).

8. *Euclid.*—Props. 18–30, Book I., and twenty deductions from Egan's Exercises.

9. *Geography.*

(*a*) Australia—Physical, climate and productions.
(*b*) Revise Spain, Portugal, Italy, Turkey, Greece, and the Balkan Provinces.
(*c*) Practise memory maps.

10. *History.*—Edward the First to Richard the Second. Chief points:—

*Edward I.*—Reduction of Wales and Statute of Wales.
War with Scotland.
Legislative measures and reforms—
1275. *First Statute of Westminster.*
1278. *Quo warranto*—inquiry into the rights of landowners.
1279. *Mortmain*—forbidding the alienation of land to religious bodies, etc.
1285. *Second Statute of Westminster*, amplifying Law of Entail.
1285. *Statute of Winchester.*—Police regulations, originating Justices of the Peace.
1290. *Quia emptores*—to prevent loss of feudal profits by subinfeudation.
1297. *Confirmatio Chartarum* (also in 1298, 1299, 1300, 1301).
Judicial Reforms—
(1.) Distinct staff of judges to each court.
(2.) Court of Exchequer: causes affecting revenue.
(3.) Court of Common Pleas: causes between private persons.
(4.) Court of King's Bench: causes affecting the sovereign.

*Edward II.*—Favourites; War with Scotland; Bannockburn; Deposition.

*Edward III.*—Hundred Years' War.
Causes—
(1.) Support given by Philip the Sixth to the Count of Flanders against the towns which mainly supported English wood trade (*chief* cause).
(2.) Support given by French to the Scots.
(3.) Attempt of French king to gain absolute possession of Aquitaine.
(4.) *Consequent* assumption of title and claim.
Black Death and Statute of Labourers; Statute of Provisors and Treason; Troubles at end of reign; "Good Parliament."

*Richard II.*—Peasants' Revolt (most important); The Lollards; Statute of Præmunire; Lords Appellant and Merciless Parliament; Causes leading to deposition.

11. *Theory of Teaching.*—Chap. iii., *Scholarship School Management.*

12. *Spelling.*—One hundred words per week from *Words commonly Misspelt.*

13. *Domestic Economy.*—Finish subject of Food. (Dietaries, means of preserving foods, sources of supply, etc.)

14. *Music.*—Chap. iii., *School Music Teacher.*

15. *French.*—Next four pages of *Le Trésor.* French Grammar and Syntax of the Noun.

16. *Physiography.*—Chaps. vi. and vii., Gregory.

17. *Freehand.*—One or two copies each week. Send up one occasionally for criticism.

### *Test Questions.*

1. Penmanship.
Large Hand:—*Highlanders.*
Small Hand:—*I praise you much, ye meek and gentle pair.*

2. Notes of Lesson.
(*a*) Rain; (*b*) A simple sentence; (*c*) Kindness to animals; (*d*) Punctuality.

3. Analyse—
(*a*) Lines 243–259.
Parse *once again, one hand employed, in letting fall, save that, no less than hers.*
(*b*) Lines 282–295.
Parse *confess fearless a soul, myself creating, though still deceived.*
(*c*) Lines 333–340.
Parse *or if found, it seems a part, than ourselves, suffering more.*
(*d*) Lines 420–428.
Parse *time itself, what conscious, nothing but his name.*

4. What were the effects on the Anglo-Saxon language of the Norman Conquest?

5. In what respects have the productions of India increased during recent years? What are the chief articles of export?

6. Write brief notes on the following:—Agra, Elephanta, Terai, Moulmein, Andaman Islands, NW. Frontier, Irrigation Works, Supreme Government.

7. Say what you can of the peoples in the Austro-Hungarian Empire.

8. Mention any important reforms instituted by the early Angevin kings.

9. Point out the differences between the Witenagemote, Great Council, Curia Regis, and De Montfort's Parliament.

10. Compare beef, pork, and fish as articles of diet. Which is the most economical way of cooking a joint?

### *Test Examination.*

A prize of One Guinea has been awarded to Miss HILDA WYLES (second year), Gillingham National School, who obtained a total of 465 marks out of 475.

## CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of THE PRACTICAL TEACHER (and *nom de plume* if desired) must be enclosed.

As a rule all replies will appear in the Correspondence Column, but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "A. T. FLUX, The Bays, Belvedere, Kent."

### ANSWERS TO CORRESPONDENTS.

*M.E.M.*—55/60. A very good essay.

*All other correspondents answered by post.*

# OUR NEW CERTIFICATE COURSE FOR 1899.

BY GEORGE COLLAR, B.A., B.SC.,
*Head-Master of the Stockwell Pupil Teachers' School.*

## TEST QUESTIONS ON THE FEBRUARY WORK.

### THEORY OF TEACHING.

FIRST YEAR.—1. What are the advantages of beginning with analysis in teaching grammar?

2. In what way may grammar be regarded as a study of the "concrete," and in what way as a study of the "abstract"?

3. Explain the terms:—syllogism, major premise, conclusion, ambiguity of the middle term.

SECOND YEAR.—1. Draw a comparison between memory and imagination.

2. What place should be allowed to "fairy tales" in the education of children?

3. What are the rules for closing registers? How do you deal with the attendance of children who enter or leave school between the time for closing registers and dismissal?

### ARITHMETIC.

1. What advantages will be gained by the introduction of the Metric System into this country?

2. Give the approximate metric equivalents for the yard, pound, acre, shilling, gallon.

3. What is an aliquot part? What aliquot parts of £1 would you take for the following:—9s. 7½d., 13s. 2¾d., 18s. 5½d., and 5s. 11½d.?

### MUSIC (BOTH YEARS).

1. What is meant by syncopation? Give examples.

2. Give the meaning of the following terms:—*accelerando, allegro, lento, andante, tempo primo.*

### ENGLISH.

FIRST YEAR.—1. Give a list of English auxiliary verbs. Show that "can" and "must" are not auxiliary verbs.

2. What do you mean by "weak" and "strong" verbs? Give reasons for not referring to the conjugation in parsing.

3. What are "gerunds"? Parse the words printed in italics in the following passages:—

(*a*) "We'd jump the life *to come.*"
(*b*) This house *to let.* This house *to be sold.*
(*c*) A very natural mistake *to make.*
(*d*) *Seeing* how matters stood, I decided *to help.*
(*e*) The business *being* ended, the meeting broke up.
(*f*) My coat *is past mending.*

BOTH YEARS.—1. Give an account of the allegory of the "Golden Scales."

SECOND YEAR.—1. Compare the characters of the two sisters Regan and Goneril, and also those of their husbands, Albany and Cornwall.

2. Explain the following passages:—

(*a*) She that herself will sliver and disbranch
From her material sap, perforce must wither.
(*b*) Milk-liver'd man!
(*c*) A century send forth.
(*d*) Be aidant and remediate
In the good man's distress.

### GEOGRAPHY (BOTH YEARS).

1. Describe in detail the volcanic phenomena of New Zealand.
2. Give an account of the trade and industries of New Zealand.

### HISTORY (BOTH YEARS).

1. What Acts imposing restrictions on persons on religious grounds were passed in the reign of Charles the Second? What was the special object of each? When were they severally repealed?

2. Describe the relations between the Netherlands and France at this period, and say what were the relations between England and each of those countries.

### GEOMETRY.

WOMEN.—1. Prove that if the line bisecting the vertical angle of a triangle bisect also the base, the triangle is isosceles.

MEN—FIRST YEAR.—1. In a given circle draw a chord which shall be double its perpendicular distance from the centre.

2. Prove that the arcs intercepted between two parallel chords are equal.

MEN—SECOND YEAR.—1. Find a geometric mean between two given straight lines.

2. In a given circle inscribe a rectangle equal to a given square.

### LATIN.

BOTH YEARS.—1. Give examples of the ablative of price, ablative of instrument, and ablative of place.

2. How does the ablative of time differ from the accusative of time?

3. Translate *In Catilinam*, chap. ii.

SECOND YEAR.—Translate *Æneid*, ix. 530–555.

### FRENCH.

BOTH YEARS.—1. Give rules for the use of the conditional mood.

2. Translate *Voyage*, chap. xxxi.

SECOND YEAR.—Translate *Le Verre d'Eau*, Act IV. Scene 3.

## SYLLABUS AND HINTS FOR MARCH.

### ENGLISH COMPOSITION.

Prepare abstracts for essays on the following subjects, and write essays on three of them:—

1. Modesty.
2. National progress.
3. "The pen is mightier than the sword."
4. Genius.
5. Procrastination.
6. Knowledge is power.
7. "Sweet are the uses of adversity."
8. Home influences.

### THEORY OF TEACHING.

FIRST YEAR.—1. Before proceeding further to the study of the methods of teaching the different individual subjects, it will be well for the student to seriously consider the question of "Notes of Lessons." The importance of this is shown by the fact that "Notes of Lessons" constitutes a whole section of the First Year syllabus.

No teacher should attempt to stand before a class without having previously run through the lesson he is about to give; in most cases he will be materially aided by making out a written scheme of the lesson. This scheme is what we call "Notes of the Lesson." Teachers are also frequently called upon to write "Notes of a Lesson" in their examinations, with a view of showing how they would teach a particular subject. In this case mention should be made of such details as "Class or age of children," "Time allowed," which a teacher would not write in notes intended simply for his own use.

The teacher should first consider what *aim* he has in the lesson. Aims which are common to all lessons, such as "Mental development of the children," should not be entered, but only the special aim of the individual lesson. The analysis of the lesson is shown by the headings, in bold writing, of the various sections. Notes are very commonly arranged in two columns—"Matter" and "Method;" and in general this division is to be recommended. At times, however, considerable difficulty is felt in deciding what is "Matter" and what is "Method." The proportion between the length of notes in each of these sections must vary considerably with the nature of the lesson. Thus, in a history lesson the bulk of the notes should be on Matter, and it would be sufficient to indicate the course to be adopted in giving the lesson by a note at the head or foot. At the beginning or end of the notes should be drawn up a list of apparatus required. This will enable the teacher to have everything ready before the lesson begins.

Indicate the points in the lessons at which you will question, and the lines your questioning will follow, but do not set down the actual questions you will ask. Some "Notes" resemble catechisms. As examples of the different style of notes required for different subjects, draw up notes on the following:—(*a*) Tea; (*b*) The War of American Independence; (*c*) Relative Pronouns.

2. *Logic.*—Further study of the rules of the syllogism. The eight fundamental rules must be thoroughly mastered. The number of possible *moods* of the syllogism—how many of these are permitted by the eight rules. *Figures*, or arrangements of the terms in the syllogism. Imperfections and extensions of the syllogism. Compound syllogisms—Prosyllogism and Episyllogism. Conditional or hypothetical syllogisms. Study carefully Cartwright, chaps. xv.–xvii., and Jevons, xv.–xix.

SECOND YEAR.—1. "Notes of Lessons." (See above.)

2. *Psychology.*—Conception. Observation of resemblances in objects. Formation of *classes* containing similar objects. Generalisation. Importance to the teacher of understanding the processes by which concepts are formed, since teaching may be

considered as consisting chiefly in supplying concepts, and in enlarging the content of these concepts. For example, by comparing certain animals seen by the child we give him a general idea, or concept, of a quadruped. Next, when we wish to teach him about a lion, we join the idea of lion to this by saying "the lion is a quadruped," and so on. But while we extend the concept "quadruped" by making it include more, we must also insist on the differences between individual quadrupeds.

Note the difference between popular concepts and scientific or accurate concepts: the former are based on superficial resemblances, the latter on deep-seated or structural resemblances. Thus the ignorant conceive of the bat as a bird because it flies, but the naturalist regards it as a mammal, widely separated from birds, and having more in common with cats and dogs.

Relation of definition to conception. (See previous papers on "definition.") Substitutes for logical definitions:—(1.) Description—for example, Euclid's so-called definition of a right angle. (2.) Instance or particular example. (3.) Type, or specimen, the employment of one object to represent others which resemble it; compare the popular expression "kind of a"—for example, The fox is a kind of a dog. (4.) Metaphorical descriptions—for example, teeth of a saw. Use of these substitutes. Assistance, or hindrance, to conception arising from the derivation of names.

### Theory of Music.

*Both Notations.*—Musical terms relating to loudness, to style, and general treatment of a piece. Musical terms should not be learned off in alphabetical order as they are usually set out in a text-book. The student should make an analysis of such a list for himself, arranging the terms in classes, subdividing, and arranging in special order, if necessary. For instance, one class should consist of terms relating to time: these could be subdivided into terms referring to uniform time, and those referring to alteration in time; the former, again, should be arranged so as to begin with *largo*, the slowest time, and ending with *prestissimo*.

### English.

First Year.—Careful study of the pronouns. Classification—Personal, Relative, Interrogative, Demonstrative, Possessive, Emphatic, Reflexive, Reciprocal. The following points are of great importance:—1. Relative pronouns must be defined as those that relate sentences, *not* as those that are related to an antecedent. In the sentence, "The man lost *his* hat," "*his*" relates to an antecedent, "*man*," but is not a relative pronoun. "His," moreover, *agrees* with its antecedent in gender, number, and person, which shows how absurd it is to refer in parsing to the agreement of a relative pronoun with its antecedent, as though this was a matter in which it differs from other pronouns.

2. Demonstrative pronouns must be distinguished from demonstrative adjectives; the latter are used *with a noun*, but the former take the place of the noun.

3. Possessive pronouns must be carefully distinguished from personal pronouns in the possessive case. Compare—"My house is larger than your house." "Mine is a larger house than yours." In the first sentence, "my" is a personal pronoun in the first person, possessive case—it stands for the person making the statement; but in the second sentence, "mine" is a possessive pronoun in the *third person* (notice the person of its verb), and in the nominative case—it stands for house.

4. The emphatic and reflexive pronouns are both formed by the addition of -self or -selves, but the latter are always in the objective case, and stand for the same person as the subject of the verb—"I have hurt myself." The former may be used with either the subject or the object of the sentence to impart more emphasis—for example, "I myself placed the book there." "I gave it to the man himself."

5. Notice the frequent use of "*as*" as a relative pronoun, especially after "such"—for example, "We are such stuff *as* dreams are made of."

Both Years.—Selections from Addison, pp. 245-317. The three papers on the "Foxhunter" were written for *The Freeholder*; the other papers on "Country Humours" were contributed to *The Spectator*, as were also those on the "Humours of Fashion." The "Conversion of the Foxhunter" is particularly full of references to what was going on at the time it was written. In connection with the "Grinning Match," the student should read the account of the grinning match won by Quasimodo in Victor Hugo's *Notre Dame de Paris*.

Second Year.—Careful study of *King Lear*, Act V.

### Arithmetic.

*Ratio and Proportion.*—Note that a ratio is nothing new, but simply another name for what we are already familiar with under the name quotient and fraction. It is *an abstract number*, showing what part or parts one quantity is of another. Observe the ways of indicating ratio, and express in phraseology applied to vulgar fractions the terms used in the theory of ratio—for example, duplicate ratio = square of the fraction. The two practical applications of the study of ratio are—(*a*) to find the ratio between two given quantities, and (*b*) to find a quantity that shall bear a given ratio to a given quantity. Thus two rules which have been taught in vulgar fractions with much labour and pain, and then studiously avoided, are now brought into use in a disguised form and under another name; for (*a*) is simply to find what fraction one given quantity is of another, and (*b*) is to find a set fraction of a given quantity.

The combination of these two rules constitutes Proportion, or Rule of Three. The so-called theory of proportion consists of a collection of simple propositions concerning two fractions that are equal. These, moreover, are only true of abstract terms in proportion; the well-known statement that "the product of the means is equal to the product of the extremes" is absurd, if applied to such a proportion as—

3 cows : 7 cows :: 4s. 6d. : 10s. 6d.,

since it is ridiculous to suppose that we can multiply 3 cows by half a guinea, or 7 cows by 4s. 6d.

*Proportional Parts.*—The division of a given quantity into a certain number of parts bearing a given ratio to one another presents little difficulty. Be careful, however, to distinguish between dividing a quantity in the proportion of certain fractions, and finding those fractions of the given quantity; thus in the question, "Divide £3, 7s. 8d. in the proportion $\frac{2}{3} : \frac{5}{8} : \frac{3}{11}$," the first result will not be $\frac{2}{3}$ of £3, 7s. 8d., but

$$\frac{\frac{2}{3}}{\frac{2}{3} + \frac{5}{8} + \frac{3}{11}}$$

of £3, 7s. 8d.

*Averages.*—Study this chapter carefully.

### Geography (both years).

*New Zealand (continued).* *Climate.*—Compare and contrast with that of Great Britain. Note that prevalent winds are north-west, hence rainfall heavier in west than in east. Climate and soil are such that every part of New Zealand, except the higher Alps, is suitable for settlement.

*Natural and Industrial Products.*—Pastoral pursuits, agriculture, and mining are the chief occupations of the settlers in New Zealand. The principal products therefore are wool, grain, frozen meat, timber, butter, cheese, gold, coal, kauri gum, flax. Study vegetable, animal, and mineral products, and chief localities of production.

*Commerce.*—The commerce is chiefly with the United Kingdom, Australia, United States of America, China.

*Exports.*—Wool, frozen meat, butter, skins, hides, tallow, kauri gum, grains.

*Imports.*—Clothing and clothing materials, iron and steel goods and machinery, tea and sugar, spirits, wine and beer, paper, books, and stationery.

*Inhabitants.*—These include settlers and natives. The *natives* are called Maoris, and are supposed to have colonised New Zealand five hundred to six hundred years ago, coming, according to their own traditions, from "Hawaiki." [Three explanations of term suggested: (1) Home; (2) Hawaii, in Sandwich Islands; (3) Savaii, in Navigator Islands.]

All the original settlements of Maoris were made on North Island. The people are not a pure Polynesian race, there being evidently an admixture of Papuan and Melanesian elements; but of all the Polynesian peoples, the Maoris are probably the finest in physique and highest in intelligence, the best type of Maori being not much inferior to the average European.

In general the Maori is courageous, quick at learning, good at imitation, but, on the other hand, vain, jealous, and revengeful. The Maoris of the present generation, having no longer to fight, are giving way to idleness.

*Government.*—The government is vested in—(1) the Governor; (2) Legislative Council of 48 members, appointed by the Governor, for seven years (prior to 1891 the appointment was for life); (3) House of Representatives, consisting of 74 members, elected for three years. The natives elect 4 Maori members.

Study position and trade of chief towns.

*Discovery and Settlement.*—In 1640 Tasman, and in 1777 Captain Cook, explored parts of the islands; but no settlements were made until 1814, when some missionaries began work.

The first colonisation was made in 1839, the first Governor was sent out in 1840, and in the following year New Zealand was separated from New South Wales, of which it had formed a dependency. For forty years (1840-81) the progress of the

colony was checked, mainly owing to the influence of—(1) two Maori wars, of 1845 and 1860; (2) the runaway convicts from Australia flocking to New Zealand. Progress was somewhat accelerated in 1861 by the rush of emigrants to the Otago goldfields. Since 1881 New Zealand has been steadily growing in importance.

ENGLISH HISTORY (BOTH YEARS).

To death of Charles the Second.

This is a very important period, and one that is generally treated in rather a summary manner. Study life of Danby. His policy was to maintain the supremacy of the English Church, as against both Romanists and Dissenters, and to oppose Louis. He was opposed by Shaftesbury, who wanted toleration for Dissenters.

Attempt to pass the Non-Resistance Bill, 1675. Charles opposed Danby by accepting a pension from Louis, and opposing the wish of the nation that the Dutch should be supported in their struggle against France.

The popularity of the marriage between Princess Mary and William, Prince of Orange, showed the strength of friendly feeling towards the Dutch.

The Peace of Nymegen, 1678, ended the hostilities between France and Holland, and not only added to French territory, but left the military prestige of France at a very high point.

The Popish Plot.

Impeachment and fall of Danby, 1679; dissolution of the Cavalier Parliament. First Short Parliament.

Charles appoints the first *Cabinet Council*, 1679, on the advice of Sir William Temple. Note the constitutional position of the Cabinet. The Privy Council is a large council of advisers of the sovereign; its members are appointed for life, and are styled "Right Honourable." This council as a whole, in theory, takes the responsibility for the acts of the sovereign, who, according to the legal fiction, "can do no wrong;" but in practice, the responsibility rests upon the chief ministers, who form a committee of this council, called the Cabinet. There are other committees of this council, as that on Education, and the Judicial Committee, which decides legal points connected with our colonies, etc., on behalf of the sovereign.

Bitter feeling against the Duke of York; attempt to pass the Exclusion Bill.

The Habeas Corpus Act. Remember its chief clauses, and compare them with those of Magna Charta.

Affairs in Scotland. Cruelty of the attempts to suppress the Covenanters. (Much light will be thrown upon this part of the history by reading Sir Walter Scott's *Old Mortality*.)

Second and Third Short Parliaments. Origin of "Whigs and Tories." Reaction in favour of the king. Trial of Shaftesbury and of Argyle. Rye-House Plot. Trial of Russell and Sidney. Monmouth obliged to leave the country. Attention should be paid to the literature of the period—Butler's *Hudibras*, 1662–3; *Paradise Lost*, 1667; *Paradise Regained* and *Samson Agonistes*, 1671; *Pilgrim's Progress*, 1678; Dryden's *Absalom and Achitophel*, 1681. (Students should read this through, to study the characters of the historical personages of the period; allowance must be made for the satire.) French literature was at its most brilliant period; Molière, Corneille, Racine, La Fontaine, and Boileau were producing their masterpieces.

ALGEBRA.

WOMEN.—Study the chapter on symbolical expression, then that on problems involving simple equations. Be careful to note that the problems are generally worked in the abstract—for example, the equations represent relations between *numbers*, not between concrete quantities; hence we take $x$ to represent the *number* of pounds, etc., and after determining what number $x$ represents in the equation, we give the answer as so many pounds, etc.

MEN—FIRST YEAR.—Study carefully the chapters on quadratic equations. Notice the *three* methods of solving quadratic equations:—

1. By factorising.
2. By completing the square.
3. By applying the formula.

(1.) Short of the bald statement of the value of $x$, as $x = 6$, the simplest form of a simple equation is that in which $x$ is written with the negative of its value as equal to 0—for example,

$$x - 6 = 0;\ x - 5 = 0, \text{ etc.}$$

If we take two such equations and multiply them together, we form a quadratic equation, as—

$$(x - 6)(x - 5) = 0;\ \text{or, } x^2 - 11x + 30 = 0.$$

Remembering that this is always the way in which a quadratic equation is built up, we can readily solve such an equation by arranging all the significant terms on the left side, and 0 on the right, and then factorising the expression on the left.

If we divide each side of the equation by the factors obtained, one after the other, we obtain two simple equations, from which the values of $x$ may be obtained.

Example:—

$$2x^2 - 7x + 3 = 0$$
$$(2x - 1)(x - 3) = 0.$$

Dividing by $(2x - 1)$, then $x - 3 = 0$,
$\therefore x = 3.$

Dividing by $(x - 3)$, then $2x - 1 = 0$,
$\therefore x = \frac{1}{2}.$

Ans. $x = 3$ or $\frac{1}{2}$.

(2.) The method of solving quadratics by completing the square is fully described in all the text-books. It should be practised in order to acquire familiarity with the method by which the general formula is obtained, but it is the least convenient method for general use. If, after bringing the equation to the general form, the student can easily find the factors, the first method is the best; but if the factors cannot readily be found, the equation should be solved by applying the formula. The intermediate steps employed in completing the square should be omitted, as they have been used once for all in obtaining the formula.

(3.) Every quadratic equation may be reduced to the general form

$$ax^2 + bx + c = 0,$$

where $a$ may have any value except 0, $b$ may have any value, positive or negative, including 0, and $c$ any value, positive or negative, including 0. Solving this equation by the method of completing the square, the student will find that

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

This formula should not be used until the method by which it is established is quite familiar.

Example:—

$$2x^2 - 7x + 3 = 0.$$

Here $a = 2$, $b = -7$, and $c = 3$.

$$\therefore x = \frac{+7 \pm \sqrt{49 - 24}}{4} = \frac{7 \pm 5}{4} = 3 \text{ or } \tfrac{1}{2}.$$

MEN—SECOND YEAR.—Solution of questions in interest and discount by means of logarithms. There are no special difficulties in this part of the work if the text-book is carefully studied, but plenty of practice is necessary in order that errors in the application of the formula may be avoided.

GEOMETRY.

WOMEN—FIRST YEAR.—Revise to end of Prop. 8, and work the exercises in the text-book.

MEN—FIRST YEAR.—Euclid III. to end of Prop. 25.

Note that in Prop. 20 the only difference between the two cases is that in the first we take the sum, and in the second we take the difference. These two cases may be made into one by saying at the right point, "Therefore the whole angle (case 1), or the remaining angle (case 2), is double of the whole, or the remaining angle....." The converse of Prop. 21 is easily proved by the indirect method, and is useful in showing that the vertices of all triangles on the same base, and having the same vertical angle, fall on the circumference of the circle which passes through the three angular points of one of them.

MEN—SECOND YEAR.—Revise Book IV., with exercises. Extend Prop. 4 to show how to *escribe* a circle to a triangle—that is, to make it touch one side of the triangle and the other two produced.

Prop. 7. Show that every parallelogram described about a circle must be either a square or a rhombus.

Prop. 8. Show that a square is the only rectangle in which a circle can be inscribed.

Prop. 8. Inscribe an equilateral triangle in a square which is inscribed in a circle. Will this triangle be inscribed in the circle?

Prop. 10. Pay particular attention to this proposition: suppose an isosceles triangle constructed such that the angle at the base is double of the angle at the vertex, and work backwards so as to prove that II. 11 must be used to obtain the point in the given line.

LATIN.

BOTH YEARS.—Careful study of the "uses of the Genitive Case."

FRENCH.

BOTH YEARS.—Syntax of the infinitive. Carefully notice points in which French differs from English in the use of the infinitive.

(Special Notes on LATIN and FRENCH will be given next month.)

# THE L.L.A. OF ST. ANDREWS.

## B.—THE DEPARTMENT OF PHILOSOPHY.

### LOGIC AND METAPHYSICS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
*Author of "Mental Science and Logic for Teachers."*

BOOKS TO BE STUDIED.

1. Jevons' *Elementary Lessons in Logic*, with Cartwright's *Mental Science and Logic for Teachers.*
2. Mill's *Logic*, Books I., II., with chaps. i.–viii., and xxi. of Book III., and Douglas's *John Stuart Mill.*
3. Ryland's *Psychology*, 7th edition.
4. Fraser's *Selections from Berkeley.*
5. *For reference only*, Minto's *Logic, Inductive and Deductive.*

### Mill's "Logic."

**Book II., Chap. i.**—"We say of a statement that it is proved when we believe its truth by reason of some other fact or statement from which it is said to *follow*." This is a very pertinent introduction to inference, for all statements except those that have to do with simple ultimate statements depend upon other statements from which they are inferred; and what we have to be sure of is, that the **inference has been valid,** and the conclusion justly drawn. This naturally leads to a consideration of what inferences are, and what inferences are not, worthy of the name.

When a proposition, said to have been inferred from another, asserts no new fact, but simply reiterates the same fact in another form, this, says Mill, is not inference.

**Inferences in Name only.**—Under this head come—
(*a*) Æquipollency.
(*b*) Sub-alternation.
(*c*) Conversion.
(*d*) Repetition of Connotation.
(*e*) And all other forms of Immediate Inference.

A few words may be said about æquipollency, which is defined as "*the perfect agreement in sense of two propositions that differ somehow in expression.*" The traditional usage has been to confine æquipollency to cases of equivalence between positive and negative forms of expression. "Not all are" is equivalent to "Some are not;" "Not more is," to "Some are." This is the best sense in which to understand this term, but it has been used in place of (1) *Opposition*, and (2) *Formal Obversion* (see Minto, pp. 147–9). Now as to the question whether this immediate inference merits the name inference at all, Mill says, "No," because "there is in the conclusion no new truth; nothing but what was already asserted in the premises, and obvious to whoever apprehends them." This, as Welton points out, if accepted as a valid objection, would be fatal to all inference; "for in every valid inference the conclusion must be a necessary consequence of the premises, and, therefore, potentially known as soon as these are fully apprehended. The step from premise to conclusion in an immediate inference is small; but this does not prove that it is no step at all, or that it is unnecessary to take it."

**Logical Inference.**—1. **Induction,** or inference from particulars to generals, the conclusion being more general than its premises.

2. **Ratiocination or Syllogism,** or reasoning from generals to particulars, or inferring from premises a conclusion never more—and, as a rule, less—general than these.

3. **Inference from particulars to particulars,** concerning which a few words must be said. To take Mill's example—if I observe that A dies, that B dies, and that C dies, and then proceed to infer that D will also die, I am arguing the truth of the last case from the three particular cases that have come within the limit of my observation; but if it is not true that all men die, may not D be one of the exceptions? The answer is certainly, "Yes." So that before I can be sure of the particular I must be sure of the general; hence this inference by particulars to particulars is simply a special form of induction, for, as Mill says, "Whenever we are *logically* warranted in arguing from a set of particular cases to some new case, we are also warranted in inferring the *general* proposition which includes the new case."

The major premise of a syllogism is got by an induction, and all that we are doing in ratiocination or syllogism is to interpret and apply an induction; hence, then, syllogism may be regarded as an ancillary or subsidiary process to induction. Wherefore, if immediate inference is not inference, if inference from particulars to particulars is only a special form of induction, and if syllogism is merely the application and interpretation of induction, then it is justifiable to say, as Mill does, that "**all Logical Inference consists in Induction, or the interpretation and application of Propositions arrived at by Induction.**"

**Is Induction truly Inference?**—"Yes," says Mill, for the facts stated in the conclusion are new facts different from those contained in the premises. As we shall see presently, the intuitionists give quite another account of induction, but at present we are concerned with getting to know what Mill means; and here it must be again remarked that the test of induction with Mill is the getting of a conclusion wider than any of the premises from which it is drawn.

**Book II., Chap. ii.**—Notice, first of all, that Barbara and Celarent are taken as types of all syllogisms—the former standing for all those with an affirmative, the latter for all those with a negative conclusion. This is perfectly reasonable. From these two cases we gather—(1) that the major premise is universal, upon which Mill founds his statement that ratiocination proceeds from a general proposition; (2) that the minor premise is affirmative, and asserts that something is contained in the class about which something has been affirmed or denied in the major premise; hence the conclusion infers that what is asserted of the whole class, whether affirmatively or negatively, may be asserted of whatever is affirmed to be in the class. This shows how the *dictum de omni et nullo* came to be received as the axiom of ratiocination—a view which Mill traverses in saying that the *dictum is not the axiom upon which syllogism rests, as it is nothing more than an identical proposition;* for to say that "whatever is true of a whole class is true of every individual in that class," is just the same as saying that "whatever is true of all the individuals is true of every one of them," which is a palpably identical proposition. Concerning this Welton says: "The dictum reads the subject in each premise—that is, the middle and minor terms—in denotation, though the major term retains its natural connotative force as a predicate. Those logicians who regarded the connotation of each term as its most important element framed an axiom corresponding to the dictum, but expressing this connotative view." This is Mill's fundamental axiom of ratiocination—namely, "**Whatever is a mark of any mark, is a mark of that of which this last is a mark.**"

In applying this to negative syllogisms, it is necessary to remember that an attribute may be a mark of the *absence* of another attribute. It will be noticed that both statements start with the minor term: the former says, "S has the mark M, which is the mark of P; therefore S has P;" whilst the latter puts it, "S is a mark of M, which is a mark of P; therefore S is a mark of P." Observe also the alternative form in which Mill expresses his fundamental axiom: "*Whatever possesses any mark, possesses that which it is a mark of.*"

**Book II., Chap. iii.**—The first question to be considered here is, **whether the Syllogism involves a Petitio Principii.** Mill says, "Yes;" but there is much to be said on the other side. Speaking strictly, this should mean that the conclusion is involved in one of the premises; but, more loosely, it is asserted "that the premises presuppose the truth of the conclusion, and therefore cannot be used to prove it." The question turns upon the meaning of a general proposition—that is, does it imply that all instances have been examined, or is it founded upon the examination of a few instances only, and "the truth of such a proposition is recognised, and even held to be necessary, before the totality of instances that come under it have been examined, or are, indeed, known"? Again, it is one thing for a fact to be so and so, and quite another for us to know it. Welton puts this clearly: "Were our knowledge complete and perfect, all truths would lie open before us, and inference would be both unnecessary and impossible. For the truth of the conclusion is, in fact, concomitant with that of the premises from which we deduce it; it does not follow them, though our perception of it may follow our perception of them." For, though the objectors to the syllogism deny the fact, it is certainly possible to accept the premises without deducing the conclusion. The strictness of the syllogistic process, and the examples of it commonly given in works on Logic, disguise this possibility, and give plausibility to the assertion that no advance in knowledge is really made by syllogism. But because, as statements of fact, the premises contain the conclusion, it by no means follows that "in studying how to draw the conclusion we are studying to know what we knew before."

**Reasoning from particulars to particulars.**—The opposite view is stated by Bradley, who contends that in arguing from one particular case we leave out certain points in which the one case does not resemble the other, and, of course, this is equivalent to passing to a general proposition wherein is stated the common resemblances, as in every case where a general name is

the subject. The case quoted by Mill—"It is not only the village matron who, when called to a consultation upon the case of a neighbour's child, pronounces on the evil and its remedy simply on the recollection and authority of what she accounts the similar case of her Lucy"—lends itself well to this view; for it may well be argued that she lost sight of her Lucy altogether, and argued from the general symptoms of such an attack, leaving Lucy, and all that was peculiarly Lucy, out of the question. It is but fair to add that many eminent logicians accept Mill's view in this connection as correct.

Mill's opinion as to the true nature of syllogism must not be lost sight of. We might argue from particulars to particulars, he says, but we prefer to resort to the general proposition and to syllogism, because it is "an indispensable collateral security for the correctness of the generalisation itself." Thus the value of the syllogism and its connected rules "does not consist in their being the form and rules according to which our reasonings are necessarily, or even usually, made, but in their *furnishing us with a mode in which those reasonings may always be represented, and which is admirably calculated, if they are inconclusive, to bring their inconclusiveness to light.*"

Why we should prefer to go through a general proposition in proceeding from particulars to particulars:—

1. *The Induction is done and done with, and may be used again and again.*

2. *It brings before the mind all that can be proved by the evidence.*

3. *It appeals to the imagination as a larger object than a particular example, and is therefore more impressive and more likely to be remembered.*

4. *Bias and negligence are thereby to a great extent guarded against.*

5. *All possible parallel cases are brought out.*

The universal type of all reasoning, according to Mill, is: "*Certain individuals have a given attribute; an individual or individuals resemble the former in certain other attributes; therefore they resemble them also in the given attribute.*"

**The major premise** asserts that one phenomenon is a mark of another phenomenon.

**The minor premise** asserts that some new case possesses the mark above referred to.

**How Induction is related to Deduction.**—Induction is more peculiarly the initial step whereby the general proposition is established—that is, whereby it is made clear what is a mark of what; whilst deduction is concerned in applying and interpreting the general proposition, in showing that particular cases are instances of its application.

The various objections, and Mill's replies thereto, should be carefully read, as they may very likely be selected for questioning in June.

**Book II., Chap. iv.**—Read up Jevons on *Sorites*, and then note Mill's definition of a *sorites*, or train of reasoning, as a *series of inductive inferences from particulars to particulars through marks of marks*; and note well the connection of these trains of reasoning with the deductive sciences, especially **mathematics.** The difficulty is to find inductions to suit particular cases, and in the combination of inductions. Note the bearing of this upon Euclid I. 3, which Mill uses in exemplification.

**Deductive and Experimental.**—These are the two opposing branches of study, not deductive and inductive; but an experimental science is one that requires a new set of observations, experiments, and inductions for each step, whereas the steps in a deductive science can be brought under old inductions, of which they are special cases. This Mill expresses by saying that in a deductive science we have marks of marks, whereas in an inductive science we have to seek such marks.

**How Experimental tends to become Inductive.**—In an experimental science there must of necessity be many isolated truths, the connection between which has not yet been seen. One day a new experiment supplies the connecting link between these various detached truths, which thus become recognised parts of a whole, the various laws now being seen to be so many more or less resembling instances of a more general law. This is what is now happening to chemistry, where it is being established that the varying properties of elements are functions of the atomic weights. This is an immense generalisation bringing into line hundreds of detached truths.

**As a Science advances it becomes quantitative.**—This we drew attention to in our discussion of Jevons, who (p. 249) justly enlarges upon the immense progress that is possible as soon as a science reaches the quantitative stage, when, as Mill says, all properties of numbers become properties of the science in question; hence the science of numbers may well be described as the grand agent for converting experimental into deductive sciences, the application of which is possible as soon as we know that variations in quantity correspond with variations in quality.

**Book II., Chaps. v., vi.**—The important consideration raised in this chapter is that dealing with necessary truth, which introduces the connected question as to mathematical conclusions, and our warrant for regarding them as so unmistakably and necessarily true. It is absolutely necessary at this point that the student should appreciate fully the difference between the attitude of the empiricist and the intuitionist towards induction. With Mill and his followers induction is the process whereby a general truth is arrived at from the experience of individual instances of its occurrence—that is, the generalisation is the product of the examination. With the intuitionists this is not so. The first thing with them is a hypothesis, which is to be tested by reference to experience. Thus Welton says: "The method of induction consists throughout in the framing of hypotheses to explain the phenomena given in experience, and the verification of those hypotheses by constant appeal to facts. For if the universal is not derived from, but is exemplified in, the particular; if it is in the facts, and by its very presence gives meaning to those facts; then it follows that every attempt to organise experience—that is, to constitute reality for ourselves—is the formulation of a supposition as to what the universal law of relation is which is exhibited in the particular phenomenon before us." The one school discovers the generalisation from the examination of the particular instances, the other goes to the particulars with a suppositious general rule which the instances are to corroborate or refute. Hence to the intuitionist Mill's statement that necessary truth is certainty of inference has no meaning, for truth is not got by inference; it is merely confirmed, thus: "General truths are, then, not derived from experience, in the sense in which the empiricist uses the word—that is, they are not obtained from simple observation of the actual connection of two phenomena. On the contrary, they are the result of such an analysis of reality as enables us to state the relation that holds between a phenomenon and its conditions. And when this relation is ascertained, the principle of the unity of the world—without which all knowledge is impossible—compels us to think it as universally and necessarily true.....Uncertainty, when it exists, pertains to the truth of the judgment in the form in which it is expressed—that is, it attaches to the accuracy and adequacy of the analysis of conditions upon which it is founded. When this accuracy and adequacy are undoubted, there is no uncertainty." This is of great importance, as it bears upon the question of the **necessity attributed to mathematical truth,** which necessity, and even certainty, Mill denies. Their necessity, he says, consists in **certainty of inference,** to prove which he avers that certain primary suppositions—to wit, the **definitions** and **axioms**—are postulated or taken as granted, and from these all other mathematical truths are inferred, so that the certainty of the truth depends upon the truth of the definitions and axioms. Mill proceeds to state that some of these suppositions—namely, the postulates in the definitions which assume the actual existence of straight lines perfectly straight, and circles with radii exactly equal—are not only not necessary, but they are not strictly true. He then discusses the question as to the origin of axioms, which he claims to be the teachings of experience; whereas the intuitionists claim that such knowledge is obtained by intuition, and not by inference from many instances of its occurrence. "The concepts and axioms on which mathematics rests are not generalisations from sensuous experience. Points and lines are not sensations, or combinations of sensations, but are the conceived limits of surfaces—in other words, **relations that exist for thought, but not for sense perception.**" Again, in reply to the contention that axioms are the deliverances of experience: "Mill says that the lines of experience approximate to straightness, and therefore, apparently, that the idea of straightness is obtained by abstracting all elements of crookedness from the imperfect lines presented to our senses. But this is to beg the question. For crookedness is known only as deviation from straightness; unless, therefore, we approach crooked lines with the idea of straightness already in our minds, it is evident we cannot know them as more or less crooked, for we have no standard by which to test them.....Throughout the discussion he is really speaking of images, or sensible representations of objects possessing certain attributes instead of concepts—that is, intelligible syntheses of these attributes. Thus we get the sufficiently absurd paradox that a 'line so *defined*.....is *inconceivable*.' How the definition which states the context of the concept is possible, though the existence of the concept itself is impossible, Mill does not explain.....The truly real figures of geometry are the accurate ones of conception, not the more or less perfect ones of perception. And of these real figures the theorems of geometry are strictly

and exactly true, whilst they are true of the material figures of sense experience just in the proportion that these approximate to ideal perfection. The necessary character of mathematical truths is not due, as Mill says, to inseparable connection in experience. This, we have seen, can only give expectation; it can never prove the truth of a universal proposition in any subject" (Welton). In support of this criticism of Mill, Dr. Bosanquet is quoted to the following effect: "It is of no use to say, I have seen it so often that I cannot help believing it true. One might almost as well say, I have said it so often that I cannot help believing it true." The late Professor Green is also quoted in the same connection: "The distinction, then, of the 'necessity' of mathematical truths from the contingency of the truths about nature, if it is to hold at all, is not to be understood as if it were only in mathematics, and not in natural science, that what is once true must always be true, or as if natural laws were liable to change, mathematical laws not. The true distinction is between what is fully true and what is partially true. What is fully true once is fully true always, of a natural phenomenon no less than a geometrical figure; but if any proposition about a natural phenomenon, is true of it only under conditions of which we do not know all, while a truth about a geometrical figure, if true at all, is true of it under conditions which were perfectly known."

**Inconceivability of the Contradictory.**—"To argue, as Mill does, that a judgment cannot be said to be inconceivable because it has at one time been held to be true, is inadmissible, except on the totally unwarranted assumption that every true proposition must have been known by all men at all times" (Welton). Green says: "Given any proposition conceived as wholly true, you cannot conceive its contradictory to be true consistently with that idea of the unity of the world without which no proposition could be conceived to be really either true or false." To which Welton adds: "But as holding a proposition to be true and its contradictory to be inconceivable are one and the same thing, it follows that inconceivability of the opposite is not, as Mr. Spencer teaches, an independent test of the truth of any proposition."

The subject is a very important one, hence it has been dwelt upon at considerable length. The student must be able to explain and criticise—(1) what Mill means by necessary truths; (2) how this is connected with mathematical certainty; (3) whether the definitions and axioms upon which mathematics rests are true, and whether axioms are known experimentally or intuitively. (4) The question as to what is done in induction should also be studied carefully, although it comes up for consideration in Book III. It will be necessary all along the line to distinguish between Mill's views and those of the empirical school, of which Locke and Hume were the founders, and the intuitionists, of whom Green has been the most logical exponent in recent times. We shall have occasion to refer to this in discussing Berkeley. In the meantime it will do the student good to ask herself whether she believes in the existence of an external world; and if she does, upon what grounds this belief rests. This will put her in a position to realise the difference between the two schools of thought.

## Douglas's "J. S. Mill."

The fourth chapter does not bear upon our present work, and need not be studied until next month, when Book III. of Mill's *Logic* will be taken, in which Causality plays an important part. Of Douglas, only the four chapters need be read by the student; meantime we begin the study of

## Ryland's "Psychology," Chap. i.

Psychology does not ask what mind is; it simply discusses the contents and acts of mind, which may be done in many ways:—

1. **The Introspective Method.**—This is by far the most important of all methods. Each may look within his own mind and examine the various states of mind, but note that it is—(1) individual, telling us nothing of minds other than our own; (2) confined to adults, and so tells nothing of child-mind; (3) states of mind constantly change, and in introspection we run the risk of knowing nothing about any other state of mind than that which is characteristic of introspection.

2. **The Objective Method,** wherein we—(1) compare the mental states of others, in so far as they may be able to describe them, with our own; and (2) may measure the sensitiveness of organs and faculties.

3. **The Physiological Method,** where, from an examination of the organ, we proceed to infer what its acts and laws may be. Closely allied to this is the Biological method, in which we study not only the organs of men but those of all living creatures, differences in mental powers being compared with differences in organ development.

4. **The Sociological Method,** in which we seek to discover how mental power is modified by society. Man gives and takes in every respect, so that his states of mind, as well as his mental powers, will be greatly modified by his surroundings, and especially so when these consist of a highly-organised community with which the individual is in constant and many-sided contact.

Whichever method we employ in our researches, we may proceed in two widely-differing ways—namely, by analysis, or by synthesis. In the former case we take the complex, such as the feeling of patriotism, and proceed to determine the elementary mental states of which it is composed. In the latter case the opposite mode of procedure is adopted, and, starting with elementary states of mind, such as the simple feelings, we endeavour to build up out of them the more complex states of mind into which they are compounded. In Psychology, as in other sciences, the best work is the practical work, and the student will best serve her purpose by starting forthwith to discover what she can as to the states of mind that she experiences.

**Relation to other Sciences.**—Metaphysics, Logic, and Biology are the sciences with which Psychology is most closely connected. If we endeavour to learn what mind is, what life is, what space, time, etc., really mean, we are entering upon a purely metaphysical research, than which nothing can be more profitless, for, with no data to go upon, it cannot be possible that much reliable progress will be made. When Psychology has reduced the mental state to its simplest elements, it is metaphysical to endeavour to go behind these and seek to discover what these simplest elements are. With Logic the connection is a very close one, and just as simple as close. Logic tests the validity of reasoning. It has, therefore, nothing to do with volition or feeling, and has very little to do with perception.

The connection between Psychology and Biology has been already indicated. What we know about life will assist us in our study of mind, because we can only have mind where there is life; hence Biology, the science which studies life, cannot but have a close connection with the science of mind. Compare this chapter with the opening chapter of *Mental Science and Logic*.

## Questions.

*February.*

1. Explain the following expressions:—*summum genus*, real proposition, separable accident. (1890.)

2. What are the rules for a good definition? What is Mill's view as to the nature of definition? Is it consistent with his account of division? (1898.)

3. State and examine Mill's view as to the nature of mathematical certainty.

4. Discuss the various ways in which the connotation of a term may be expressed when the definition of that term is under consideration.

5. Distinguish clearly between verbal and real propositions, and give one or two examples of each. Is the distinction important? Give reasons.

6. Explain clearly what Mill meant by "real kinds" and "not-real kinds." Give an example of each. What has tended to make this distinction less important? Give details. Has this question any bearing upon Mill's views as to the reality of external nature?

7. What do you understand by a nominal and what by a real definition? Discuss the difference implied by these terms, and illustrate them by examples.

8. Give the substance of Mill's views upon classification. What are the predicables, and how are they connected with classification?

*March.*

MILL.

1. All inference is from particular to particular. Examine this statement. (1897.)

2. Discuss the question as to the certainty of mathematical truths.

3. Simply describe Mill's position with respect to axioms, and proceed to criticise this statement.

RYLAND.

1. Define Psychology, and clearly state the difference between Psychology and Metaphysics.

2. Show in what respect Psychology is connected with (*a*) Metaphysics, (*b*) Logic, (*c*) Biology.

3. "What is known of life will be the best guide to what is knowable of mind." Discuss this statement of Mr. G. Lewes.

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Answers to the questions set are corrected by the author of this course at a charge of 10s. for the whole series of questions.

All communications should be addressed "L.L.A. Course," c/o Editor *P.T.*

# LONDON MATRICULATION.

*June* 1899.

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## LATIN.

*Course for March.*

1. Cicero, *In Catilinam* I. Revise the second half.

2. Grammar.—Learn the verbs of the third conjugation that are irregular in the perfect and supine. Notice, too, the changes in verbs when they are compounded with prepositions. In the Syntax, note how questions are asked in Latin—(*a*) direct, (*b*) indirect, (*c*) simple, (*d*) disjunctive. The rules for the sequence of the tenses of the subjunctive, the difference of the uses of the tenses of the indicative in Latin and English, and the uses of the negatives, should also be prepared. Revise the uses of the cases and the declensions.

3. *Anglice Reddenda*, 68–76.

4. Sentences from Bradley's *Arnold* or Bayfield's or Allen's *Exercise Book*.

*Latin Grammar Notes.*

Know the different usages of *haud*, *nov*, and *ne*, to express "not." *Ne* is used in wishes and prohibitions. (N.B.—It is also used to translate "that not" in negative final clause.) *Ne* is also used as an affirmative particle meaning "surely," generally with the second personal pronoun. *Haud* is normally used before adjectives and adverbs. Note, however, the use of *haud* with a verb in the phrase *haud scio an*, "I am inclined to think." Cicero uses *haud* also occasionally with the other parts of *scio*. Better not imitate this. The various interrogative particles used in asking questions are important. Notice *num*, *ne*, *nonne*. *Num* expects the answer "no," *nonne* the answer "yes;" *ne* is used for information, and is an enclitic. Note that the *e* in *ne* interrogative is short.

Distinguish the different methods of translating "whether .....or." In a question use *utrum.....an*. Remember that "whether.....or," in an adverbial clause, is translated by *sive .....sive*. In some cases it is hard to tell whether the clauses are adverbial or not. The best method of ascertaining it is this: If you can take away the "whether.....or" clause and leave the sense complete, then the "whether.....or" clause is adverbial. If, however, the absence of the clause would leave the sense incomplete, then the clause is an interrogative one. Remember that *an* is not used in the first portion of disjunctive questions. Where *an* apparently is used in this way, there is always an ellipse of the first alternative.

Postgate notices some cases in which the tense of the indicative in Latin differs from the tense in English. *Postquam* is followed by the perfect indicative, instead of the pluperfect, if the exact time after is not mentioned—for example, *Postquam hoc fecimus Balbus abiit*, "After we had done this Balbus went away." Again, after the words *si*, *cum*, *donec* (until), etc., when the principal verb is in a future tense, the future is used with these words in Latin when the time of the action expressed by the principal sentence and the dependent sentence is the same—for example, *Hoc faciam cum potero*; we say, "I shall do this when I can." *Hoc faciam cum possum* would be bad Latin. If, however, the action of the dependent clause is antecedent to that of the principal clause, use the future perfect indicative in the dependent—for example, *Non ei ignoscam donec de hac re me certiorem fecerit*, "I shall not pardon him till he has informed me of this," lit. "till he shall have informed me concerning this matter." Here the information is given before the pardon is granted, and as the verb of pardoning is in the future, the verb of information is in the future perfect.

The rule for the sequence of tenses must be thoroughly known and applied. The proof of your knowledge of a rule lies in the application of that rule. No rule has been oftener sinned against—there is no rule which proves such a source of joy to the examiner and a casting down of eyes for the candidate. It has been fully explained in our typical sentences; I shall, however, sum it up again. This rule regulates the tenses of the subjunctive to be used in dependent clauses. If the verb in the principal clause is in a secondary or historical tense (that is, in the imperfect, pluperfect, aorist perfect), the imperfect or pluperfect subjunctive is to be used. If the principal verb is in a primary tense (that is, in the present, future, future perfect, present perfect, and imperative), use either the present or the perfect subjunctive. The historical present will be followed by either primary or secondary sequence. For fuller details see the sentences previously given.

*Test Paper In Catilinam I., chaps. i.–vi.*

(Readers can have their solutions corrected on enclosing seven stamps.)

1. Translate—(*a*) § 5, Castra sunt.....dicat; (*b*) § 11, Cum proximis.....coniunctam; (*c*) § 15, Sceleri ac furori.....defigere.

2. Explain the historical allusions in the following passages:—

(*a*) Ahala Sp. Maelium occidit.
(*b*) Interfectus est Gaius Gracchus.
(*c*) Num L. Saturninum mors ac reipublicae poena remorata est?
(*d*) Te imperatorem tua illa Manliana castra desiderant.
(*e*) Quam diu mihi consuli designato insidiatus es.
(*f*) Castra sunt in Italia contra populum Romanum in Etruriae faucibus collocata.

3. Write grammatical notes on the following:—

(*a*) Quid superiore nocte *egeris quem* nostrum ignorare arbitraris?
(*b*) Satisfacere *reipublicae* videmur, si tela *vitemus*.
(*c*) C. Gracchus clarissimo patre interfectus est.
(*d*) Quid est quod iam amplius *exspectes?*
(*e*) Non tam *sui conservandi* causa quam tuorum consiliorum reprimendorum profugerunt.
(*f*) O di immortales! ubinam *gentium* sumus?
(*g*) Statuisti quo quemque proficisci *placeret*.
(*h*) Dixisti paulum tibi esse etiam nunc *morae* quod ego *viverem*.
(*i*) Reperti sunt duo equites qui te *ista cura liberarent*.
(*j*) Quos tu ad me *salutatum* miseras.
(*k*) Quos *id temporis* venturos praedixeram.
(*l*) Cui adulescentulo quem *corruptelarum* inlecebris *irretisses* non facem praetulisti?
(*m*) Quae quidem quibus abs te initiata sacris ac devota sit nescio. (Translate.)
(*n*) Ceterorum tamen nostra *qui remansissemus* caede contentum esse dicebas.

4. Parse fully—*devota*, *inretisses*, *interitu*, *iussero*, *oblivisci̊re*, *oblivisci̊re*.

5. What was the formula for investing the consuls with dictatorial power?

6. From what other sources do we learn the details of the Catilinarian conspiracy? What effect on Cicero's after-life had this conspiracy?

7. Accent the following words—*machina*, *interitu*, *desiderant*, *libido*.

8. Give the English for—*nullo tumultu publice concitato; sentina reipublicae; inter falcarios;* A.D. XII. *Kal. Nov.; atque adeo; hebescere*.

*Latin Test Paper.*

(Readers can have their solutions corrected on enclosing seven stamps.)

1. Give the perfect subjunctive, active and passive (when found), third plural, of (*a*) the following verbs when compounded with *cum—tango, ago, rego, duco, quatio;* (*b*) the following verbs when compounded with *ad—tango, iacio, habeo, haereo, quaero, emo*.

2. When are the supines in *-um* and *-u* used? Give examples.

3. How is the want of a perfect active participle supplied? Give examples. What verbs have a perfect participle, active in meaning?

4. How is the subjunctive used in principal sentences? What negative is used in each case? Illustrate your answer by examples.

5. Show how *must* and *ought* are translated into Latin.

6. Give the future participle, genitive, feminine, singular; the pluperfect subjunctive, active, second plural; the present indicative, passive, second singular; and the perfect subjunctive, passive, third singular, of—*condo, circumdo, elicio, vinco, vivo, facesso, arcesso, repello, descendo, pario, comperio, aperio*.

7. What is meant by *gerundival attraction?* Quote instances from *In Catilinam* I.

8. Correct or justify :—

(*a*) Nos a militibus parcendi sumus.
(*b*) Tu et ego abivisse debuimus.
(*c*) Videtur eum esse caecum.
(*d*) Omnes nostrum speraverunt hoc facere.
(*e*) Aedes struxit ad deos colendum.
(*f*) Misit milites pacem petere.

*Sentences.*

"No one can be so pleased with his fortune as to never grow weary of life."

*Nemo fortuna sua tam contentus esse potest ut unquam se vitae tadeat.*

Notes.—(*a*) *So* before an adjective or adverb is *tam ;* before verbs, *sic, ita,* or *adeo.* (*b*) *Contentus* is followed by the ablative. (*c*) "That" in consecutive and final clauses is expressed by *ut,* and the subjunctive is required. Note, however, when there is a negative in the clause, that *ut non* is used in consecutive clauses, and *ne* in *negative final* clauses ; so here *ut unquam* is used, not *ne unquam.* (*d*) *Taedeat* is used impersonally, and takes the accusative of the person and the genitive of the thing.

"There are some who think that they can go away from the city of Rome at once."

*Sunt qui se ab urbe Roma abire posse putent.*

*Sunt qui,* "there are some who," is followed by the subjunctive. When a relative has an indefinite antecedent the subjunctive is used in the relative clause, hence *putent.* This use of *qui* is called *generic.* The subjunctive is known as the *generic* or *descriptive* subjunctive.

"Balbus was accused of betraying the city, but was unanimously acquitted by the jury."

*Quod urbem prodidisset Balbus accusatus omnium iudicum sententiis est absolutus.*

Notes.—(*a*) *Of* and a *verbal* noun, when depending on a verb, are never expressed by the genitive of the gerund in Latin. The general way of expressing "of" and the verbal is by using *quod* (because) and a finite verb. The subjunctive will be used with *quod* if the reason given is the opinion of some one other than the speaker or writer. Consequently, in the sentence above we use *quod* and the subjunctive, as the reason given is evidently that of the people who brought the accusation (literally, "He was accused because, as they said, he had betrayed the city.") This subjunctive is called the subjunctive of sub-oblique narration, or virtual oblique narration. (*b*) Note the use of the participle *accusatus* and the finite verb *est absolutus,* instead of using two finite verbs connected by *et.* (*c*) *Sententiis* is the instrumental ablative, hence there is no preposition.

"So far was he from praising Caesar, that he censured him severely for sparing Brutus."

*Tantum aberat ut Caesarem laudaret ut eum graviter culparet quod Bruto pepercisset.*

Notes.—(*a*) *Tantum aberat ut.....ut*—literally, "So far was it absent that.....that." The *ut* in both cases will require the subjunctive. This is one of the ways of translating *instead of* with a verbal noun. (*b*) Note the tense of *laudaret* according to the rule of the sequence of tenses. The time of *laudaret* is the same as that of *aberat,* therefore the imperfect tense is used. (*c*) "For" and a verbal noun depending on a verb are not generally expressed by the gerund or gerundive in Latin. Here they are equivalent to a clause introduced by "because," therefore use in Latin *quod* and the subjunctive. The subjunctive is used because the reason given is the alleged reason (sub-oblique narration, as in the sentence given above).

*Latin Sentences for Practice.*

(Readers can have their solutions corrected on enclosing seven stamps.)

1. So far is he from telling you what he intends to do tomorrow, that he will not even tell you what he did yesterday.
2. There is no one who would venture (*audeo*) to accuse him of murdering his uncle (*patruus*).
3. I cannot censure him for informing your friends that he stopped in Rome ten days.
4. All of us promised to do all we could to save this man's life.
5. He is so delighted with this praise that he never stops (*desino*) talking of what he intends to do.
6. Let each of them remember why we went to Athens.
7. If I had ordered you to go to Naples (*Neapolis*), you would have disobeyed (*non parco*) me.
8. May he be fortunate (*felix*), and never be obliged (*cogo*) to ask his brother for money (*pecunia*).
9. The braver a man (*quis*) is, the less he likes these.
10. When he saw that your friend was satisfied, he said nothing more.

## ENGLISH.

*Course for March.*

Grammar.—Nesfield, pages 246–265.

History.—Revise from the Norman Conquest to the death of Elizabeth.

Literature.—Stopford Brooke's *Primer of English Literature,* chaps. iii. and iv.

*Notes.*

Grammar, pp. 246–265.—Note § 404. The fewness of Celtic borrowings. Many words formerly supposed to have been Celtic are now known to have been borrowed by the Celts. § 407. Note the characteristics of Danish borrowings—the tendency to resist palatalisation. § 409. Note the two sets of Dutch borrowings. § 410. Note the Latin borrowings distinct from the French. Nesfield points out that the old classification of French and Latin borrowings in four periods is faulty. The *Latin* borrowings may be divided among four periods—(*a*) up to 596 ; (*b*) 597–1066 ; (*c*) 1066–1485 ; (*d*) from 1485 onward. There are three sets of French borrowings—(*a*) up to 1350 ; (*b*) 1350–1660 ; (*c*) from 1660 onward. The classes of words introduced at these periods are important. Note in § 415 how English verbs are formed from Latin verbs. Note in § 417 the distinction between popular and learned words, and the changes in form and in meaning which popular words have undergone. It is difficult to decide in many cases whether an English word comes direct from a Latin word or from a French "learned" word. Note § 422 on the accentuation of Late French words. § 423. Influence of Greek on English. § 425. Learn a few examples of words that have come into English from the various European languages.

## MATHEMATICS.

### GEOMETRY COURSE.

Finish and revise the Third Book. Read at the same time the worked-out problems of the Second Book.

Solutions to last month's riders :—

1. This is an important proposition, and may be found at the end of the proposition (III. 22) in Hall and Stevens. It is proved indirectly, as is common with converse propositions.

2. From O, the centre of the circle, draw OA perpendicular to the given straight line. From OA cut off OB equal in length to the perpendicular distance of the given chord from O. Through B draw PBQ, a chord of the circle perpendicular to OA, and hence parallel to the given line. This chord PQR is, by III. 14, readily seen to be equal in length to the given chord.

3. Let BAC be the given angle, and AD any line through A equal to the given altitude. Draw PDQ perpendicular to AD, cutting AB AC in P and Q respectively. APQ will be the triangle required.

4. Let ABC be the given triangle. Bisect BC in D. Then ABD is half the given triangle. Bisect BD in P, and draw PR perpendicular to BD to meet a parallel through A to BD in R. The BRD will be an isosceles triangle, equal in area to triangle ABD. Complete the parallelogram BRDQ; this will be a rhombus of double the area of triangle ABD—that is, equal to triangle ABC.

Riders for March :—

1. On a given straight line to describe a triangle of given altitude and vertical angle.
2. To describe a circle touching a given line and passing through two given points.
3. Prove that if a parallelogram be circumscribed to a circle it must be a rhombus or a square.
4. To construct a rectangle equal to the difference of two given squares.

### ARITHMETIC COURSE.

Chaps. xxxv. to xxxix. and plenty of the examples should be worked.

Solutions to last month's examples :—

1. Let per cent. be such that £1 amounts in 1 year to R £,

then $$400\ R^2 = 441,$$

$$\therefore R^2 = \frac{441}{400},$$

$$\therefore R = \frac{21}{20} = 1{\cdot}05,$$

$\therefore$ 100 R = 105, or the per cent. is 5.

2. In 1 year £400 amounts to $\frac{400 \times 21}{20}$, or £420.

In 2 years ,, ,, $\frac{420 \times 21}{20}$, or £441.

In 3 ,, ,, ,, $\frac{441 \times 21}{20}$, or £463, 1s.

∴ it is 3 years almost exactly.

3. Income on £10,000 4 per cent. stock is £400 per annum; if sold at £90 per share, there being 100 shares, the proceeds will be £9000.

This invested in stock at £80 will purchase $\frac{9000}{80}$, or $\frac{900}{8}$ shares, and hence an income of $\frac{£900 \times 3}{8}$ a year—that is, of £337, 10s.

4. Here price paid for the stock = £80¾ + ¼ = £80½.

∴ number of shares bought = $\frac{1610}{8\frac{1}{2}} = \frac{3220}{17}$.

∴ income is £$\frac{3220 \times 3}{17} = \frac{9660}{17}$ = £568 approx.

On selling, the seller gets £80 a share, having to pay 2s. 6d., or £⅛ on each share sold.

∴ proceeds of sale = £$\frac{3220}{17} \times 80$ = £15,153 approx.

Note that the brokerage increases the price by £⅛ to the buyer, and decreases it by the same amount to the seller.

Questions for March :—

1. Find present value of £441 due 2 years hence at 5 per cent. compound interest.
2. An article is sold for 17 shillings, at a profit of 10 per cent. What did it cost?
3. At what time between 7 and 8 o'clock are the hands of a watch opposite each other?
4. What number will divide both 145 and 1375, giving a remainder of 2 in each case?

## ALGEBRA COURSE.

Chaps. xxvii. and xxviii. In the former chapter about every third example should be worked, and in the latter every alternate one.

Questions set last month :—

1. $x = 3$ or 1.
2. $x = 3$, $y = 1$; $x = 1$, $y = 3$.
3. Is an ordinary multiplication sum.

Illustrative examples :—

1. Factorise $(x + 3y)^3 - 8(x - 2y)^3$

$$(x + 3y)^3 - 8(x - 2y)^3 = (x + 3y)^3 - (2x - 4y)^3$$
$$= [(x + 3y) - (2x - 4y)][(x + 3y)^2 + (x + 3y)(2x - 4y) + (2x - 4y)^2]$$
$$= (7y - x)(7x^2 - 8xy + 13y^2)$$

2. Factorise $x^4 + 64a^4$

$$x^4 + 64a^4 = x^4 + 16a^2x^2 + 64a^4 - 16a^2x^2$$
$$= (x^2 + 8a^2)^2 - (4ax)^2$$
$$= (x^2 - 4ax + 8a^2)(x^2 + 4ax + 8a^2)$$

3. Prove $a^3(b - c) + b^3(c - a) + c^3(a - b) = -(a - b)(b - c)(c - a)(a + b + c)$.

In the expression $a^3(b - c) + b^3(c - a) + c^3(a - b) = A$,

put $b - c = 0$; that is, $b = c$;

it then $= 0 + c^3(c - a) + c^3(a - c) = 0$,

∴ $b - c$ is a factor (Art. 230, Hall and Knight).

Similarly, $(c - a)$ and $(a - b)$ are factors.

We have now obtained $(b - c)(c - a)(a - b)$ as three factors, and as A is of four dimensions, we have one factor left to find, which factor must be simple (that is, of one dimension) and symmetrical.

It is therefore $a + b + c$.

We thus have

$a^3(b - c) + b^3(c - a) + c^3(a - b) = k(b - c)(c - a)(a - b)(a + b + c)$,

where $k$ is some numerical factor.

Taking the case

$a = 1$, $b = 2$, $c = 3$ we get $1(-1) + 8(2) + 27(-1) = k(-1)(2)(-1)(6)$.

∴ $k = -1$.

∴ $a^3(b - c) + b^3(c - a) + c^3(a - b) = -(b - c)(c - a)(a - b)(a + b + c)$.

Examples :—

1. Prove

$$(x - 3y)^3 + (2x - y)^3 + (4y - 3x)^3 = 3(x - 3y)(2x - y)(4y - 3x).$$

2. Prove

$$(x^2 + y^2 + z^2 - xy - xz - yz)^2 = (x - y)^2(y - z)^2 + (y - z)^2(z - x)^2 + (z - x)^2(x - y)^2.$$

3. Factorise $3x^2 - 2y^2 + 5xy + 2x - 3y - 1$.

4. Solve $x^2 - 3x + \frac{1}{x^2 - 3x} = 10\frac{1}{10}$.

5. Solve $x^3 + 1 = 0$.

## GENERAL ELEMENTARY SCIENCE.

Chaps. xi. and xvi. of Jones and Simmons, and some practical work if possible.

The appended test paper is selected from last January's papers :—

1. The sum of three fractions is 2; the first exceeds the second by ½, and the second exceeds the third by ¼. Find them.

2. If $lx + my + nz = a$, $nx + my + lz = b$, prove that $x$ must exceed $z$ by $\frac{a - b}{l - n}$.

3. Is it possible for two numbers to have 100 for their sum and 3000 for their product? Give your reasons.

4. In a given circle inscribe a triangle equiangular to a given triangle, so that one of its sides passes through a given point.

5. What is a second of time?

6. Describe an experiment illustrating the principle of Archimedes.

(The authors of this course will be glad to correct answers to the back papers.)

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*Nondescript.*—For Kirchoff's experiment, refer to Gregory's *Advanced Physiography* (Nelson), pp. 182-3. It refers to the bodies and conditions of the same, and gives respectively continuous or bright-lined spectra, and the inferences as to the constitution and condition of those bodies that may legitimately be drawn therefrom.

*Gaudium.*—Simplify

$$\frac{\sqrt{(x^2+y^2)^2-(x^2-y^2)^2}}{\sqrt{(x^2-y^2)^2+4x^2y^2}} \times \frac{x^4-y^4}{\sqrt{(x^2+y^2)^2-4x^2y^2}} - 2\left(\frac{x+1}{\frac{1}{x}+\frac{1}{y}}\right)^2$$

(Scholarship, 1898.)

We obtain—

$$\frac{\sqrt{4x^2y^2}}{\sqrt{x^4+2x^2y^2+y^4}} \times \frac{(x^2+y^2)(x^2-y^2)}{\sqrt{x^4-2x^2y^2+y^4}} - 2\frac{x^2y^2(x+1)^2}{(x+y)^2}.$$

That is,

$$\frac{2xy}{x^2+y^2} \times \frac{(x^2+y^2)(x^2-y^2)}{x^2-y^2} - \frac{2x^2y^2(x+1)^2}{(x+y)^2}.$$

That is,

$$2xy - \frac{2x^2y^2(x+1)^2}{(x+y)^2}.$$

If in the last term we had $x+y$ instead of $x+1$, the answer would be $2xy - 2x^2y^2$, or $2xy(1-xy)$.

The above may be written—

$$\frac{2xy(x+y)^2 - 2x^2y^2(x+1)^2}{(x+y)^2},$$

which reduces to $2xy(x^2+y^2+xy-x^2y-2e^2y) \div (x+y)^2$.

*Timothy.*—(*a*) An equilateral triangular area is immersed in water with a side 1 foot in length on the surface. Find the pressure upon it. (Besant's *Hydrostatics.*)

Taking the plane of the triangle to be vertical, the whole pressure on it in pounds weight is

(area) × (depth of centre of gravity) 62·5

$$= \left(1 \cdot \frac{1}{2} \cdot \frac{\sqrt{3}}{2}\right) \times \left(\frac{1}{3}\frac{\sqrt{3}}{2}\right) 62{\cdot}5$$

= 125 oz.

(*b*) If the number of arrangements is 60, the number of re-arrangements must be 59, for the letters are supposed to be already arranged in *one* way—namely, in the order in which they occur in the word "multiple."

*A. M. B. Wright.*—If the mass of A be 6 tons, and it be placed at a distance of 10 yards from C, and if the mass of B be 10 tons, and it be placed at a distance of 6 yards from C, compare the attractive influences of A and B on C.

(Cusack's *Physiography.*)

The law of gravitation states that any two particles of matter attract each other with a force which is proportional directly to the product of their masses, and inversely as the square of their distance apart.

If A and B were at the *same* distance from C, the forces which they would exert on it would be in the ratio of their masses—namely, 6 to 10. Again, if the masses of A and B were equal, the forces which they would exert on C would be inversely proportional to the squares of their distances from C—that is, as $6^2$ to $10^2$.

Compounding these two ratios, the answer is $6^3$ to $10^3$, or 216 to 1000.

*A. M'Laren.*—A cylindrical hole is cut centrally through a sphere so as to remove half its volume. Find the ratio between the diameter of the hole and that of the sphere.

The portion removed will consist of a *cylinder* and two *segments of a sphere*.

From text-books you will find that the volume of a spherical segment is $\frac{\pi}{6}(6a-2h)h^2$, where $a$ is the radius of sphere and $h$ the height of segment.

Now let $x$ be the distance from centre of sphere to the centre of the base of segment, then

$$\text{Vol. of cylinder} = \pi(a^2-x^2)2x$$

$$\text{Vol. of 2 segments} = 2\left[\frac{\pi}{6}\{6a-2(a-x)\}(a-x)^2\right]$$

$$= \tfrac{2}{3}\pi(2a+x)(a-x)^2.$$

Hence we have

$$\pi(a^2-x^2)2x + \tfrac{2}{3}\pi(2a+x)(a-x)^2 = \tfrac{2}{3}\pi a^3,$$

which simplifies to $x^3 = a^3 \div 2$

or $x = a \div \sqrt[3]{2}$.

Now, if $r$ be the radius of cylinder,

$$r^2 = a^2 - x^2$$

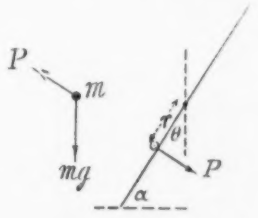
$$= a^2 - \frac{a^2}{\sqrt[3]{4}} = \frac{a^2}{\sqrt[3]{4}}(\sqrt[3]{4}-1).$$

$$\therefore r = \frac{a}{\sqrt[3]{2}}(\sqrt[3]{4}-1)^{\frac{1}{2}} = \cdot 609a.$$

*Anxious.*—A smooth plane lamina of given mass, M, can turn freely round a horizontal axis, which is in its plane and passes through its centre of gravity. The lamina is placed at a given inclination, $\alpha$, to the horizon, and a particle of given mass, $m$, is placed on it at a point below the level of the axis, and at a given distance, $a$, from it. Write down the equations of the motion of the lamina and particle, and show from them that the initial pressure of the particle on the plane is

$$mMgk^2 \cos\alpha \div (Mk^2 + ma^2),$$

where $Mk^2$ is the moment of inertia of the lamina with respect to the axis. (S. and A. Dept., May 1898.)




Let AB represent an edge view of the lamina, O being an end view of the axis through the centre of gravity. Consider first the *mass*, $m$. As the angle $\theta$ varies, the distance, $r$, of $m$ from O varies also, so that $m$ traces out a curve, $r$ and and $\theta$ being the polar co-ordinates of a point on the curve.

Now the *impressed* or *external forces* which act on $m$ are two, as shown separately in above figure—namely, $mg$ vertically downwards, and the reaction, P, of the lamina at right angles to the latter.

Resolving these forces along and perpendicular to the radius vector, we have—

Along the radius vector, $\quad O + mg\cos\theta \quad . \quad . \quad (1).$

Perpendicular to radius vector, $P - mg\sin\theta \quad . \quad . \quad (2).$

Now the accelerations of $m$ along, and perpendicular to, the radius vector are

$$\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2, \text{ and } -\frac{1}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right). \quad (3) \text{ and } (4).$$

(See text-book—for example, Williamson and Tarleton's *Dynamics*, Art. 28.)

Hence the forces of inertia along and perpendicular to radius vector are

$$-m\left[\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2\right], \text{ and } -\frac{m}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right). \quad (5) \text{ and } (6).$$

Taking (1) and (5), also (2) and (6), we have, from D'Alembert's principle, the equations

$$mg\cos\theta = m\left[\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2\right]. \quad . \quad . \quad . \quad . \quad (7).$$

$$\text{and } P - mg\sin\theta = -\frac{m}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right),$$

$$\text{or } P - mg\sin\theta = -\frac{m}{r}\left(r^2\frac{d^2\theta}{dt^2} + 2r\frac{dr}{dt}\frac{d\theta}{dt}\right) \quad . \quad . \quad (8).$$

Taking the moments (about O) of the components (1) and (2), also (5) and (6), we have

$$Pr - mgr\sin\theta = -r\cdot\frac{m}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right) \quad . \quad . \quad . \quad . \quad (9).$$

Consider now the *lamina*. The only external force producing rotation about O is the pressure from $m$—that is, P. Using the fundamental relation

$$\text{angular accel.} = \frac{\text{Moments of external forces}}{\text{Moment of inertia}},$$

we obtain

$$\frac{d^2\theta}{dt^2} = \frac{Pr}{Mk^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10).$$

The motion of lamina and particle is obtained from equations (7), (8), (9), (10).

Substitute the value of $\frac{d^2\theta}{dt^2}$ from (10) into (8), which may then be solved for P, giving

$$P = Mk^2\left(mg\sin\theta + 2m\frac{dr}{dt}\frac{d\theta}{dt}\right) \div (Mk^2 + mr^2).$$

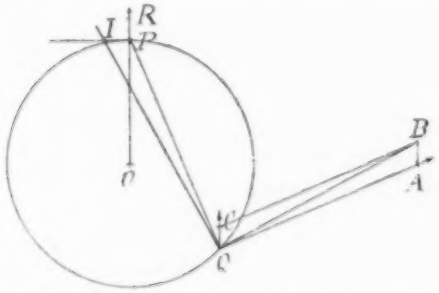
Now, initially, the particle has no velocity along the radius vector—that is, $\frac{dr}{dt} = 0$. Also the lamina has no angular velocity, hence $\frac{d\theta}{dt} = 0$. Therefore, by putting in these values, and $a$ for $r$, also $\cos\alpha$ for $\sin\theta$, the initial pressure is $Mk^2mg\cos\alpha \div (Mk^2 + ma^2)$.

*Carlo.*—Prove that in all cases of uniplanar motion there is at every moment an instantaneous axis of pure rotation.

A point, P, in the perimeter of a circular lamina 12 in. in radius is at any instant moving, in a normal direction outwards, with a velocity of 6 in. per second, and at the same time the lamina itself is rotating about P, counter clockwise, with an angular velocity $\pi$; find the instantaneous centre and its distance from P. (S. and A. Dept., 1898.)

(See text-book—for example, Williamson and Tarleton's *Dynamics*, chap. ix., or Minchin's *Uniplanar Kinematics*, Art. 28.)

Let the normal PR represent the absolute velocity of P—that is, $\frac{1}{2}$ foot per second. Take *any* other point, Q, on the lamina; then whatever additional velocity Q may have, it must have a velocity, QC, equal to PR, because P and Q are points on the same *rigid* body. But since Q has an angular velocity, $\pi$, about P as centre, then Q has a linear velocity,




QA, of $\pi$ . PQ, and at right angles to PQ. The absolute velocity of Q will be QB.

Draw QI and PI perpendicular to QB and PR respectively; then I is the instantaneous centre for the line PQ, and therefore for the lamina of which PQ is a fixed part.

$$\text{Now} \quad \frac{IP'}{PQ} = \frac{\sin PQI}{\sin PIQ} = \frac{\sin\alpha}{\sin\beta} = \frac{QC}{CB} = \frac{\cdot5}{\pi PQ},$$

$$\therefore IP = \frac{\cdot5}{\pi} = \cdot16 \text{ foot.}$$

PQI = $\alpha$, because PQ and QI are drawn respectively perpendicular to QA and QB. For a similar reason PIQ = $\beta$.

*S. Ughtred Sharpe.*—Three sums of money were divided between A and B; the first sum in the ratio of 7 to 13, and the second in the ratio of 13 to 23. The third sum was equal to the other two sums together, and B's share, in each case, exceeded A's share by the same amount. In what ratio was the third sum divided between A and B?

(Coll. of Preceptors Cert. Exam. First Class Arith., Midsummer, 1898.)

First satisfy yourself that if the difference of the two shares (for any of the sums) be taken from the sum, the remainder is twice the smaller share.

Let $S_1$, $S_2$, $S_3$ denote the three sums. Then from the first statement of the problem the difference between the shares of the first sum is $\frac{6}{13}$ of that sum.

Again, the difference between the two shares of the second sum is $\frac{1}{12}$ of that sum.

$$\text{Hence} \quad \tfrac{6}{13} \text{ of } S_1 = \tfrac{1}{12} \text{ of } S_2,$$

$$\text{or} \quad S_1 = \tfrac{1}{12} \times \tfrac{13}{6} \text{ of } S_2 = \tfrac{13}{72} \text{ of } S_2.$$

$\therefore$ the three sums must be in the ratio of

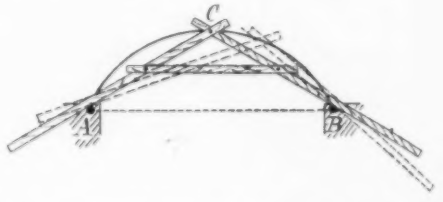
$$200 \ : \ 216 \ : \ 416.$$

Letting these numbers represent the sums, the difference of the shares in the third case (being the same as in the first case) will be represented by $\frac{6}{13}$ of 200, or 60. Taking 60 from 416, we get 356, which must represent *twice* A's share; hence the latter is represented by 178, and therefore B's share is 416 − 178, or 238. The ratio of the two shares is therefore 178 : 238, or 89 : 119.

*A. T. Clarke.*—To describe an arc of a circle with strips of wood forming a triangle. (*Geometry*, T. W. Good, p. 36.)

The method is based on Euclid, III. 21.

By putting a nail through the pieces at C, and in addition a bar across from one piece to the other, we get a rigid frame—that is, the angle ACB is fixed.




Now imagine the two rods nailed at C to be fairly long, as shown. Then you will see that so long as these rods rest against the two pins, AB, in block, we shall have a triangle with A and B, a base AB of constant length, and a constant angle opposite to it; hence, by Euclid, C must describe a circular arc. Another position of the bars is shown dotted.

*Excelsior.*—A man borrows £20,000 at 5% compound interest. If the principal and the interest are to be paid by 20 equal annual instalments, find the amount of each of these, having given

$$\log 105 = 2{\cdot}0212, \text{ and } \log 3767 = 3{\cdot}576.$$

(Hall and Knight's *Elem. Algebra.*)

£20,000 at 5% compound interest will amount in 20 years to $20000 \times 1{\cdot}05^{20}$.

At the end of the first year the borrower pays back an instalment S. Now observe that this sum S would become $S \times 1{\cdot}05^{19}$ in the 19 years remaining before the debt is paid off; the next instalment S would become $S \times 1{\cdot}05^{18}$ by the time the debt was paid off; and so on.

Hence we must put
$S\,1{\cdot}05^{19} + S\,1{\cdot}05^{18} + \ldots\ldots S\,1{\cdot}05^{2} + S\,1{\cdot}05 + S = 20000 \times 1{\cdot}05^{20}$;
or if $1{\cdot}05 = R$, we have

$$S(R^{19} + R^{18} + \ldots\ldots + R + 1) = 20000\,R^{20},$$

$$S\left(\frac{R^{20} - 1}{R - 1}\right) = 20000\,R^{20}.$$

$$\therefore S = 20000\,\frac{R^{20}}{R^{20} - 1} \times R - 1 = 1000\,\frac{R^{20}}{R^{20} - 1},$$

$$S = 1000\,\frac{1}{1 - \frac{1}{R^{20}}}.$$

Now to find $\frac{1}{R^{20}}$ write

$$\log \frac{1}{R^{20}} = \log 1 - 20 \log 1{\cdot}05 = -\cdot424$$

$$= \bar{1}{\cdot}576,$$

$$\therefore \frac{1}{R^{20}} = \cdot3767.$$

$$\therefore S = 1000\,\frac{1}{1 - \cdot3767} = 1000\,\frac{1}{\cdot6233} = 1604.$$

*H.R.H.*—The united ages of a man and his wife are six times the united ages of their children. Two years ago their united ages were ten times the united ages of their children, and six years hence their united ages would be three times that of their children. How many children had they?

Let $x$ be the united ages of the man and wife.
" $y$ " " " their children.
" $z$ " number of "

Then
$$x = 6y \quad \ldots\ldots\ldots\ldots \quad (1).$$
$$x - 4 = 10(y - 2z) \quad \ldots\ldots\ldots \quad (2).$$
$$x + 12 = 3(y + 6z) \quad \ldots\ldots\ldots \quad (3).$$

By means of (1), (2) and (3) become

$$6y - 4 = 10y - 20z, \text{ or } y - 5z = -1,$$
and $$6y + 12 = 3y + 18z, \text{ or } y - 6z = -4.$$

From the equations on the right, by subtracting, we have $z = 3$.

*H. P. Wright.*—The sum of 4 numbers in G.P. is 15; the sum of their squares is 85. Find the numbers.
(176 Misc. Ex., Todhunter's *Algebra*.)

Let $a$ be the first term and $r$ the common ratio; then from the question we have

$$a(1 + r + r^2 + r^3) = 15, \text{ or } a[(1 + r) + r^2(1 + r)] = 15,$$
$$a^2(1 + r^2 + r^4 + r^6) = 85, \text{ or } a^2[(1 + r^2) + r^4(1 + r^2)] = 85.$$

The right-hand equations become

$$a(1 + r)(1 + r^2) = 15 \quad \ldots\ldots \quad (3).$$
and $$a^2(1 + r^2)(1 + r^4) = 85 \quad \ldots\ldots \quad (4).$$

To eliminate $a$, square (3) and divide by (4), thus—

$$\frac{a^2(1 + r)^2(1 + r^2)^2}{a^2(1 + r^2)(1 + r^4)} = \frac{225}{85} \quad \ldots\ldots \quad (5).$$

Cancelling $(1 + r^2)$ and multiplying across, (5) becomes

$$14r^4 - 17r^3 - 17r^2 - 17r + 14 = 0 \quad \ldots \quad (6).$$

Because of the particular manner in which the coefficients occur, we are enabled to solve equation (6) by dividing throughout by $r^2$, obtaining

$$14r^2 - 17r - 17 - 17\frac{1}{r} + 14\frac{1}{r^2} = 0,$$

or $$14\left(r^2 + \frac{1}{r^2}\right) - 17\left(r + \frac{1}{r}\right) - 17 = 0,$$

or $$14\left(r + \frac{1}{r}\right)^2 - 17\left(r + \frac{1}{r}\right) - 28 - 17 = 0.$$

Solving this quadratic for $r + \frac{1}{r}$, we get

$$r + \frac{1}{r} = \frac{5}{2}, \text{ or } -\frac{9}{7}.$$

Solve each of these for $r$; the values so obtained are $r = 2$ or $\frac{1}{2}$, from which $a = 1$ or 8.

*Timothy.*—Prove that light which has been refracted into a sphere from vacuum can never be totally internally reflected.
(Aldis, *Optics*, p. 13.)

If a ray of light travelling in a vacuum is incident at an angle $i$ with the normal to the surface of a dense medium, whose refractive index is equal to $\mu$, then the angle of refraction, $r$, of the ray in the dense medium is given by

$$\frac{\sin i}{\sin r} = \mu.$$

If, on the other hand, a ray of light travelling in a dense medium, whose refractive index is $\mu$, is incident at an angle $i'$ on the surface dividing this medium from a vacuum, the angle of refraction $r'$ into the vacuum is given by

$$\frac{\sin i'}{\sin r'} = \frac{1}{\mu}.$$
$$\therefore \sin r' = \mu \sin i'.$$

In all transparent media $\mu$ is greater than 1. Hence when $i'$ has such a magnitude that

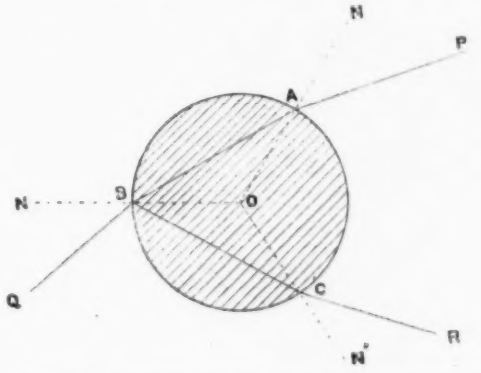
$$\mu \sin i' = 1,$$

the ray refracted into the vacuum will be parallel to the separating surface. If, on the other hand,

$$\mu \sin i' > 1 \quad \ldots\ldots\ldots \quad (1),$$

no light can be refracted out of the medium, since it is impossible to find any angle $r'$ whose sine is greater than 1.

Equation (1) therefore gives us the condition for the total reflection of light travelling in a medium whose refractive index is $\mu$, and incident at an angle $i'$ on a surface separating this medium from a vacuum.




Let ABC represent the section of a sphere, say, of water ($\mu = 1{\cdot}33$) surrounded by a vacuum. Let PA be a ray incident, at an angle PAN = $i$, with the normal ON at the point A. Then AB will be the ray refracted into the sphere, if $\angle OAB = r$ satisfies the equation

$$\sin r = \frac{\sin i}{\mu} \quad \ldots\ldots \quad (2).$$

The ray AB will be incident at B at an angle $i' = r$, since the triangle AOB is isosceles.

The condition that total reflection should take place at B is that

$$\mu \sin i' > 1.$$

But since $i' = r$, this would give

$$\mu \sin r = \sin i > 1,$$

which is inconsistent. Indeed, it may easily be seen that the angle of refraction N'BQ is equal to the angle of incidence PAN.

Further, the ray BC reflected at B will be incident at C at an angle OCB = OBC = OBA, and consequently total reflection cannot take place at C. Similarly, total reflection cannot occur at any of the points of incidence of successively reflected rays.

The question here answered might have been put in a more general form, thus: Prove that light which has been refracted into a sphere *from any medium* surrounding the latter can never be totally internally reflected.

1. *T.J.I., St. Albans.*—The best book for the advanced stage of Science (Subject I.) is Angel's two volumes, 10s. (Collins).

2. *Advanced Physiography, 1898.*—The effects referred to are due to refraction and absorption by the atmosphere. See Cartwright's Appendix to Gregory's *Advanced Physiography*, pages 286–288.

(Replies to "Integer" and "Progress" unavoidably held over.)

# OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

## NOTES ON PHYSIOLOGY:

### EMBRACING THE SUBJECTS OF THE ADVANCED AND HONOURS STAGES, SCIENCE AND ART DEPARTMENT.

BY WALKER OVEREND, M.A., M.D. (OXON), B.SC. (LOND.),
*Physician to the Tottenham Hospital;*
*Late Radcliffe Fellow, Scholar of Balliol College, and Exhibitioner in Comparative Anatomy of the London University.*

*The Blood.*—If a rabbit be killed by bleeding, and the blood as it flows from the body in the liquid state be allowed to run into a test-tube containing a saturated solution of magnesium sulphate, it does not coagulate. If the test-tube be placed within a beaker containing pieces of ice, the corpuscles subside to the bottom, and a much clearer liquid remains above, which is magnesium-sulphate *plasma*.

1. Dilute about 1 cubic centimetre of this plasma with twenty times its volume of water, and place in a chamber about 35° C. A clot is formed in about twenty minutes which is colourless and consists of pure *fibrin*.

2. Add to one volume of the plasma an equal quantity of a saturated solution of sodium chloride, and allow to stand. A precipitate is formed, which is *fibrinogen*. On filtering this off, and adding a further quantity of solid sodium chloride, after standing, a further precipitate, *fibrinoplastin* (or *paraglobulin*), is formed. This precipitate is dissolved in water and added to the first precipitate, also dissolved in water. On keeping it in the warmth for a little time a clot (*fibrin*) is also produced.

3. Besides these two substances, paraglobulin and fibrinogen, there is evidence also that a third substance is necessary—that is, fibrin-ferment.

4. Wash a piece of blood clot carefully in water, breaking it up gently under a small stream from a tap, and strings of *fibrin* will finally be left.

5. There is evidence also that the *lime salts* in the blood *play an important rôle* in coagulation. For if blood be received direct into a dilute solution of oxalate of potassium it will not coagulate. If, however, excess of calcium sulphate be now added, the blood clots rapidly.

6. *The Colouring Matter of the Blood.*—Allow blood to flow from a frog (which, in order to deprive it of sensation, has been already pithed). This may be done by opening the ventricle. Collect the blood, and agitate it with a twig so as to separate the fibrin. It is now defibrinated, and will not clot. Dilute it several times, and place in a test-tube in front of the slit of a pocket spectroscope. Add water gradually if necessary, and note two dark bands between the red and green. The observer should first define the D line by placing a fragment of common salt in the Bunsen flame, and noting the yellow band which is the position of the D line.

7. Add a drop of ammonium sulphide to the blood and warm gently. Now observe the spectrum: there is only a single dark absorption band. Make out its position. This is the spectrum of reduced hæmoglobin. Oxyhæmoglobin possesses two absorption bands, but the addition of ammonium sulphide has removed the oxygen, and reduced hæmoglobin is left.

8. *Carbonic-Oxide Hæmoglobin.*—Prepare carbon monoxide, and pass the gas through diluted blood for a few minutes. The blood becomes cherry-red in colour, and on examination by the spectroscope two bands are visible, almost in the same position as the oxyhæmoglobin bands. Add a few drops of ammonium sulphide, and warm as before. No change in the position of the bands results, showing the much greater stability of the carbonic-oxide hæmoglobin. In poisoning by charcoal fumes this gas is the active agent. It combines with the hæmoglobin and prevents it from taking up oxygen in the lungs and conveying it to the tissues. Rapid poisoning is the result.

9. *Preparation of Hæmin Crystals.*—Dry a drop of blood on a glass slide, add a crystal of common salt, and place a few drops of glacial acetic acid with them. Cover with a coverslip, and warm over a Bunsen flame for a few minutes. Allow to cool, and examine with the microscope. Note the numerous small rhombic plates of a nut-brown colour. These are crystals of hæmin.

10. *The Properties of Bile.*—The flow of bile is continuous, but it is not directly into the small intestine, being stored up in the gall bladder until the acid chyme passes over the orifice of the common bile duct. It is believed that about two pounds are secreted daily. Bile is alkaline in reaction, and slimy in its consistence, from the presence of mucin. It contains: bile salts, 10 per cent.; mucus and colouring matter, 2 per cent.; fat, 1 per cent.; lecithin, cholesterin, and salts, 1 per cent. The bile salts (*bilin*) and fat are manufactured by the protoplasm of the liver cells. The bile pigment (*bilirubin*) is derived from the hæmoglobin of the blood. The mucus (*mucin*) is produced by the mucous membrane of the gall bladder. The bile salts consist of glycocholate and taurocholate of sodium. These bodies are readily split up in the intestine into glycin, taurin, and cholic acid.

11. *Test for Mucin.*—Add acetic acid: mucin is precipitated.

12. Digest a little egg-albumin at the body temperature (98° F.) with dilute hydrochloric acid (0·2 per cent.): acid albumin is formed. Add a drop of bile: a precipitate falls of acid albumin. Add a larger quantity of bile: little or no precipitate falls, as the acid albumin is changed into alkali albumin, which is soluble.

13. Boil 1 cubic centimetre of bile with 3 cubic centimetres of strong hydrochloric acid for a few minutes. A resinous mass separates, which consists of cholic acid with bile pigment. Taurin and glycin pass into solution.

14. Add a solution of cane sugar to bile in a test-tube and shake up well. Pour a few drops of strong sulphuric acid down the side of the tube: a purple colour is produced (*Pettenkofer's test for bile salts*).

15. *Test for Bile Pigment.*—Place a drop of bile on a white piece of porcelain, and add a drop of strong yellow nitric acid. A play of colours results—green, blue, then red, and finally yellow. Bile pigment can be obtained direct from dog's bile by shaking it with chloroform and pipetting off the solution. On allowing the chloroform to evaporate a pitchy residue is left.

16. *Functions of the Bile.*—(*a*) The first action of the bile is to neutralise the acidity of the gastric juice, and prepare the way for the pancreatic juice. (*b*) Bile also helps in the absorption of fats. Oil will not run through a filter paper moistened with water, but it will gradually pass through the paper if it be moistened with bile. This is the chief function of the bile.

## CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
*First Class Honourman in Chemistry (Science and Art Department); Head-Master, Finchley School of Science, and Lecturer therein on Chemistry.*

**Pure Argon.**—In *The Chemical News* for January 27 and February 3 is a long paper setting out the method whereby neon, krypton, metargon, and xenon were separated from argon so as to leave nothing but the pure gas. The apparatus is figured, and full particulars are given as to the mode of working.

We cannot give a *résumé* of the paper on account of its nature, but we recommend every Honours student, whether for Part I. or Part II., to carefully study the paper in question, which may be said to settle the elemental nature of argon. The following particulars will give some idea of the nature of the rest of the paper:—

"In order to prepare 15 litres of argon, it is necessary to deal with about 1,500 litres of atmospheric air, of which, approximately, 1,200 litres consist of a mixture of nitrogen and argon. To absorb the nitrogen contained in this quantity of gas by conversion into nitride, four kilograms of magnesium would be theoretically required; but in order to cover loss through leakage and incomplete action, five kilograms of the metal were employed. The absorption of the oxygen and hydrogen was conducted in three stages. In the first, the oxygen was removed by means of metallic copper; in the second, the nitrogen was passed twice over metallic magnesium; and in the third, the gas, now rich in argon, was finally freed from nitrogen and hydrogen by passage over a mixture of anhydrous lime and magnesium powder heated to a red heat, and subsequently over red-hot copper oxide." Then follow details as to the experiment, which, as above stated, we recommend to the notice of all Honours students.

**Colour of Calcium Carbide.**—Moissan has devoted himself to the question as to whether the red colour of crystals of $CaC_2$ is natural or due to impurity. He finds that pure $CaC_2$ is transparent and colourless.

**Aluminium.**—M. Ditte finds that when aluminium is placed in dilute acid it dissolves rapidly at first, but a layer of the gas is deposited on the surface, which resists further action. This layer is found to adhere very firmly to the metal. By getting rid of the gas as fast as it is formed, either by working at reduced pressure or by some other means, it is found that the metal dissolves away altogether. In the case of a solution of common salt the following reaction takes place—

$$Al_2 + 6NaCl + 3H_2O = Al_2Cl_6 + 3Na_2O + 3H_2 + 157{\cdot}3 \text{ cals.}$$

This is followed by a double decomposition—

$$Al_2Cl_6 + 3Na_2O = Al_2O_3 + 6NaCl + 287 \text{ cals.},$$

and the deposit of the layer of $Al_2O_3$ arrests further action. The same reaction occurs when a plate of aluminium is placed in a solution of a salt of the alkaline earths. In fact, the author's experiments tend to show that aluminium is attacked in a more or less marked manner by all chemical agents.

**Separation of Hg and Bi.**—A new method of separation is due to Herrn Vanino and Treubert. It is based on the complete precipitation of the $HgCl_2$, in the form of $Hg_2Cl_2$, in dilute HCl solution, by a mixture of hydrogen peroxide and hypophosphorous acid. The Bi remains in solution, and can be subsequently precipitated by a fresh addition of hypophosphorous acid. To the dilute HCl solution of the salts of Ag and Bi we add an excess of a solution containing one drop of ammoniacal hypophosphorous acid for each cubic centimetre of peroxide of hydrogen. After standing for an hour, the $Hg_2Cl_2$ is filtered off, and quietly washed with dilute HCl, then with distilled water, after which it is dried at 105° C. The filtrate is heated, and made slightly alkaline with caustic soda. We then add the hypophosphorous acid, and heat the solution, whilst constantly stirring, until a black precipitate is formed and the liquid becomes clear. The Bi is filtered off in a Gooch crucible, and washed, first with water, then with alcohol, and dried at 105° C.

**Preparation of Lithium Ammonium, Calcium Ammonium, and the Amides of Lithium and Calcium.**—M. Henri Moissan has shown that K, Na, Li, and Ca combine with ammonia gas, and that the ammonium compounds thus formed decompose at ordinary pressure at the following temperatures:—+ 70° for Li, + 20° for Ca, − 2° C. for K, and − 20° for Na. Lithium and calcium ammonium take fire in contact with air at ordinary temperatures, and correspond to the formulæ $NH_3Li$ and $(NH_3)_2Ca$. These two compounds do not dissociate at ordinary pressure and temperature in an atmosphere of ammonia gas. They are stable compounds, which lend themselves to addition and substitution reactions more easily than the ammonium alkalis.

**Free Hydrogen in Air.**—M. Armand Gautier has conducted a long series of experiments on specimens of air taken from high mountain regions and over the sea. He finds that hydrogen is present in the proportion of about 1·5 vols. to 10,000 vols. of air. This proportion is very much greater in specimens of pure air than in specimens taken from the neighbourhood of towns, whilst the proportion of combustible carbon compounds is considerably less.

**Composition of Mantles for Incandescent Gas-Burners.**—The commercial incandescent mantles now so much in use consist almost entirely of thorium oxide, $ThO_2$, to which is generally added a small quantity of cerium oxide, $CeO_2$, composing from 0·5 to 2·0 per cent. With the exception of a small quantity of lime, the mantles contain only traces of other impurities, amongst which are thorium nitrate, and the oxides of zirconium, neodymium, canthanum, and yttrium.

**Sodium Oxalate in Volumetric Operations.**—Herr Sörensen recommends the use of normal oxalate of soda to form carbonate of soda for determining the value of the acids used in volumetric determinations. He prepares the pure substance as follows:—One part of commercial oxalate of soda is dissolved in 32 parts of water at 15° C.; this solution is a saturated one. Caustic soda is added until the solution is slightly alkaline. It is then left in a large beaker until it becomes quite limpid, when it is filtered to free it from impurities, of which $CaC_2O_4$ is the commonest. Evaporation to one-tenth the original volume is the next operation, and it is performed in a water-bath in which sodium oxalate crystallises, the mother liquor containing most of the soluble impurities, of which the chief are—$K_2C_2O_4$, NaHO, and alkaline chlorides and sulphates. Recrystallisation gives a pure product. $Na_2C_2O_4$ contains no water of crystallisation; it can be heated to 125° to 150° without decomposition. Not being hygroscopic, it is an easy matter to weigh it with exactness; further, by simple calcination in a platinum crucible, provided with a cover to prevent spitting, a known weight of $Na_2C_2O_4$ can be converted into $Na_2CO_3$—all of which facts go to prove the fitness of the oxalate for conversion into a reliable soda carbonate.

**Marsh's Apparatus for the Determination of Arsenic.**—Sir William Crookes gives, in his *Select Methods of Chemical Analysis*, a hint worthy of remembrance in connection with the usage of the well-known Marsh's test for As. "Every one," he says, "who has experimented with an extemporised Marsh's apparatus has found that after the gas had burned for a short time, the glass tube has become fused and the aperture closed." To obviate this he recommends the platinising of the extremity of the tube, which may be readily done in the following way:—The tube is drawn out and filed to make it a little rough, and is then dipped into a concentrated solution of platinic chloride in such manner as to take up a drop. Heat is now carefully applied to the end until it assumes a beautiful metallic appearance. This operation of taking up a drop and heating until the metallic appearance comes is gone through three or four times, after which the jet may be lit without any fear of closure.

**Simple Test for As in either Organic or Inorganic Matter.**—The following mode of procedure is recommended by MM. Mayençon and Bergeret, and is also adopted by Sir William Crookes. For a test paper, some tissue-paper is moistened with $HgCl_2$, and is to be used wet, not after it has dried. Pure zinc is placed in a small flask containing distilled water acidulated with $H_2SO_4$. The neck of the flask is imperfectly closed with cotton wool, by which means drops of liquid are prevented from falling on the tissue-paper. Pure hydrogen will be found to have no effect upon the bichloride paper; but if the hydrogen is accompanied by only a trace of arsenuretted hydrogen, a lemon-yellow spot upon the tissue-paper indicates the presence of the arsenic. After a time the lemon-yellow becomes a pale yellowish brown. If any trace of antimony is in the flask, the antimonuretted hydrogen produced in the reaction will give a brownish-grey spot upon the bichloride paper, which is totally distinct from the spot due to the arsenical compound, from which it may thus be readily distinguished by mere inspection. Sir William Crookes adds that the reaction is an exceedingly delicate one.

## NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

**Formation of Ground Moraines.**—In his recently-issued *Anatomy of the Earth's Crust*, Professor James Geikie deals with the vexed question of the formation of ground moraines. The professor opines that the greater part of the moraine stuff is obtained from the bed in which the glacier moves, the ice being credited with the power of extracting pieces of rock from the bed, which are used as tools to plough and grind away more. There must have been a start in this process, and it is therefore assumed that blocks must somehow or other have got to the bottom of the glacier from the sides; for the erosive power of ice itself is very small, its function being to act as the tool-handle, the firm frozen boulder

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being the effective instrument in the formation of "flour of rock" and other detrital matter that is left in the track of a thawed glacier to form the well-known boulder clay.

**Seals as Proofs of Subsidence.**—Mr. A. P. Low has made a survey and a study of the northern part of the peninsula of Labrador from Richmond Gulf to Ungava Bay. Amongst the most interesting of his discoveries is Seal Lake, situated to the north of Clearwater Lake, so called because of the seals that flourish in its waters, fresh though they be. According to Mr. Low, the distance—100 miles—of this lake from the nearest sea-water, and its position—800 feet above the sea-level—preclude the possibility of migration being taken as the explanation of the existence of this seal colony. He rather leans to the belief that the seal must have reached this inland position during the glacial period when there was a subsidence. Striæ and other marks of glacial action were frequently met with, and many ancient marine terraces were noted.

**Water-spouts at Eden, New South Wales.**—Mr. H. C. Russell communicates to *Nature* for February 2 some very interesting matter concerning water-spouts which were formed at Eden, May 16, 1898, on an unusually large scale. In the early forenoon, during a light north-west wind, with fine weather and a smooth sea, a heavy bank of cloud rose above the eastern horizon, and there was a flickering as if electric discharges were going on between the cloud and the sea, but nothing to indicate what was to follow. During the morning there were fourteen clear and distinct water-spouts, reaching from clouds to sea. The process of formation was—a rotary motion of the waves, large quantities of broken water being raised gradually as a white misty-topped column, the misty part preceding the denser part by 100 to 150 feet. This went on for three or four minutes, during which time the clouds had formed an inverted cone, which seemed to be alternately dipping down and receding, with an interval of about thirty seconds between the dips, until the two cones met and all the misty matter was absorbed. The column then remained unchanged for some minutes, the overhanging cloud getting denser, and moving slowly until the spout got out of the perpendicular and divided in the middle, the top part rising, while the lower half sank in the ocean.

**The Plan of the Earth and its Causes.**—Dr. J. W. Gregory lectured to the Royal Geographical Society on January 23, in a truly interesting and suggestive manner, on the above subject.

1. *There is a Plan.*—This is apparent from the following well-known considerations: (*a*) the concentration of land in the northern and water in the southern hemisphere; (*b*) the triangular form of the geographical units, and the southward tapering of the land masses; (*c*) the antipodal position of oceans and continents.

2. *Attempts at Explanation.*—These are simplified by remembering that the earth consists of three parts: (*a*) the internal and unknown **centrosphere,** (*b*) the rocky crust or **lithosphere,** (*c*) the oceanic layer or **hydrosphere.** The following are some of the most distinguished men who have applied themselves to this problem of explanation: (1) *Professor G. H. Darwin*, who points to tidal wrinkles in the viscous lithosphere as the explanation; (2) *Prinz*, who claims that torsion, caused by the acceleration of the equatorial and southern belts of the earth and retardation of the northern land belt, is the cause of the arrangement; (3) *Lubbock* and *Lapworth*, who put forward the plea that the intercrossing of two sets of folds, one at right angles and the other parallel to the equator, explains the matter; (4) *Lord Kelvin*, who considers that shoaling in the last molten layer of the globe, over areas determined by previous segregations in the nebula, has caused the continental form.

3. *The Tetrahedral Theory.*—Dr. Gregory champions this theory, which does not regard the earth as a regular tetrahedron, but suggests that, owing to crust-collapse due to contraction, the lithosphere has experienced a tetrahedral deformation. Professor Preston is quoted in confirmation of this view. He says that "experiments on iron tubes, on gas bubbles rising in water, and on rubber balloons, all tend to bear out the assumption that a homogeneous sphere tends to contract into a tetrahedron."

4. *Some Consequences of the Theory.*—The lithosphere would be depressed on four faces, which, being lower, would naturally form the ocean basins. The four projecting coigns would stand up as continents. There would be a central ocean (the Arctic) on one face, which would be surrounded by a belt of land, and from this meridional continents would run south, and to the south of these would be an Antarctic continent; in a word, the arrangement of land and water would be exactly as it is at present. In addition, a tetrahedral plan characterises the arrangement of the main mountain masses and watersheds.

5. *Geological Support.*—The northern land belt appears to be founded on three great coigns of Archean blocks 120° apart—namely, the Scandinavian, the Canadian, and the Manchurian. South of the coigns, lines of elevation on the meridional edges would be expected; and though the geological structure of the country along the three lines differs fundamentally, the three lines of recent or still continuing earth movement of the Andes, Erythrean right valley, and East Australian coast, appear in the right positions. Moreover, the arrangement of land and water and the arrangement of the mountain system at the end of the Palæozoic period show that the tetrahedral geological symmetry is more than a recent incident—it being understood, however, that in that period the positions were reversed, the southern belt being the land belt, the ocean belt then being the northern one, whilst the meridional land lines obtained then as now.

6. *Conclusion.*—Such a change in the areas of tetrahedral flattening would be impossible in a stationary world, but in a revolving globe, the collapse consequent upon contraction is steadily resisted and confined within narrow limits by the effects of the rotation, which tends to restore the world to the more stable spheroidal form. The great mountain-building periods of the earth's history may be due to instability, caused by periods of slow deformation; and the periods of great marine transgressions (for example, the repeated Mesozoic transgression after the mountain elevations at the close of the Palæozoic) are easily explained as due to the restoration of more regular spheroidal form.

Hence the distribution of land and water on the globe may be regarded as the result of two opposing forces—collapse due to secular contraction causing deformation, and the tendency due to the earth's rotation towards the recovery of the spheroidal form. The plan of the earth may be attributed to the *continuous foundering of the lithosphere in consequence of the unceasing shrinkage of the centrosphere.* Various objections to this theory, such as the earth's so-called oblate-spheroidal shape, are discussed in the account given of this lecture in *Nature*, upon which these notes are founded. The suggestiveness of the paper should commend it to the careful attention of Honours students of Physiography.

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**Important to School Managers and Teachers.**—School managers and teachers should remember that the temporary arrangements made by the Department of Science and Art for the examination of pupil teachers and ex-standard scholars at their own schools will, as explained in Circular $\frac{397}{\text{Art}}$, be discontinued after the 31st of March next.

After that date pupil teachers and ex-standard scholars can only be examined in drawing at the general Art examinations held by the Department of Science and Art in April, May, or June.

Consequently, pupil teachers who desire to obtain grants for drawing under Article 102 and Schedule III (A), paragraphs 5 to 7, of the Code, and who have not been examined for the purpose at their schools, must this year attend the evening Science and Art examinations to be held in April and May 1899, or the day examinations in June 1899.

The time tables and rules for these examinations will be supplied on application to the Secretary, Department of Science and Art, London, SW. No time should be lost, as, in the case of the April and May examinations, "external students" (which term covers most of the pupil teachers) have to "apply *before 2nd March* to the secretary of the nearest special local district or to the secretary of the managers of the nearest school where an examination in the subject they require will be held.

"A fee not exceeding 2s. 6d. may be charged by the special local secretary or the managers."—*Science and Art Directory*, 1898, page 300.

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# MATHEMATICS.

## STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,

*Mathematical and Mechanical Division, Royal College of Science, London; Lecturer on Theoretical Mechanics, City of London College.*

### Stage 2.

*Algebra.*

*Simultaneous Equations involving Quadratics.*—These equations prove to be very troublesome to the beginner; and no wonder, because there are so many types of equation, each requiring a special method of solution. To put it shortly, a student has to be prepared to try a lot of dodges or artifices before he can have

much success. But there is one type which may be worked by quite a straightforward and certain method. For example, if we have to solve

$$\text{(i)} \quad x^2 - xy + y^2 = 76$$
$$\text{(ii)} \quad x + y = 14$$

we may write (ii) as $x = 14 - y$, or $y = 14 - x$. We are thus said to express $x$ in terms of $y$, or $y$ in terms of $x$. Instead of $x$ in (i) write $14 - y$, and (i) becomes a quadratic equation in $y$. Solve it for $y$ and put the values, in turn, in (ii); we then find the corresponding values of $x$.

We might have put $14 - x$ for $y$ in (i), and the work would have been similar, values of $x$ being obtained first this time.

It will be clear that when one equation, like (i), contains nothing but terms in $x$ and $y$ to the *first power*, there is a simple substitution for $x$ in terms of $y$, or $y$ in terms of $x$. With an equation like $x + y^2 = 4$ we should say that the substitution of $4 - y^2$ for $x$, or of $\sqrt{4 - x}$ for $y$, is not so simple, and we should not often use such a substitution.

Similarly, if $xy = 6$, then $6 \div y$ for $x$, or $6 \div x$ for $y$, are both simple substitutions.

But if the equations are, say, like these—

$$\text{(i)} \quad x^3 - y^3 = 56$$
$$\text{(ii)} \quad x^2 + xy + y^2 = 28$$

we cannot substitute for $x$ or $y$ in any simple way. We cannot help a student except by reminding him that in such equations he must try various artifices, such as (1) divide (i) by (ii), or (ii) by (i); (2) subtract (i) from (ii); (3) add (i) to (ii); (4) look out for factors; (5) adding the same quantity to each side of one of the equations. The object generally is, to find by one of these dodges an equation which enables us to easily substitute for $x$ or $y$.

Here are a few examples:—

1. Solve $x^3 + y^3 = 152$ . . . . . (i).
$xy(x + y) = 120$ . . . . . (ii).

You are expected to observe that $x^3 + y^3$ has factors, and that one of them, $x + y$, occurs in (ii); therefore divide (i) by (ii), and simplify. You will get

$$15x^2 - 34xy + 15y^2 = 0.$$

Now you ought to remember that an equation of this special form, containing nothing but terms in $x^2$, $xy$, and $y^2$, is an equation from which we can find, *not* $x$ or $y$, but $\frac{x}{y}$. For, divide throughout by $y^2$, and you get a quadratic in $\frac{x}{y}$; from this determine $\frac{x}{y}$, then you may use this to substitute into (ii).

The answers are $x = 5$ or $3$; $y = \cdot3$ or $5$.

*N.B.*—Try adding (i) to (ii) and factorising.

2. Solve $x^2 - xy = 8x + 3$
$xy - y^2 = 8y - 6$

You are expected to observe that there is a common factor of $x^2 - xy$ and $xy - y^2$—namely, $x - y$.

Divide (i) by (ii); then, owing to the coefficients of $x$ and $y$ in (i) and (ii) having been cunningly made the same—8—you find that after simplifying you may easily substitute.

The answers are $x = 3$ or $-\frac{1}{3}$; $y = -6$ or $\frac{2}{3}$.

Try subtracting (ii) from (i); you get a quadratic for $x - y$.

*Read* Hall and Knight, Art. 206; or Hamblin Smith, Art. 258; or C. Smith, Art. 158. Apply the method there given to solve Ex. 3.

3. Solve $2x^2 + 3xy = 20$
$2xy + 3y^2 = 39$
Ans. $x = \pm 2$, $y = \pm 3$.

4. Solve $2y^2 = 2x^2 + 1$
$2(y^2 - 1) = xy$

Rearranging slightly, we have

$$2y^2 - 2x^2 = 1$$
$$2y^2 - xy = 2$$

*Select* and *work* examples from your text-book.

### *Trigonometry.*

*Logarithms.*—There are very many little difficulties which present themselves to one working at logarithms for the first time. A student will find that he makes mistakes in twenty or more different ways; success only comes by working out many examples. We cannot attempt to refer to all the kinds of errors, but we shall try to explain a few difficult points.

In the first place, we strongly advise a student to rely on knowing that $\log 1 = 0$, $\log 10 = 1$, $\log 100 = 2$, $\log 1000 = 3$, and so on; if a number lies between 100 and 1000—say, 324—its logarithm lies between 2 and 3.

*Ex.* 1.—What is $\log \cdot0324$?

We are using Bottomley's four-figured tables, where $\log 324$ appears as 5105. Now 324 lies between 100 and 1000, hence $\log 324$ is really $2\cdot5105$. Commencing with 324, shift the decimal place in the number one to the left, and at the same time subtract 1 from the logarithm; we repeat to ourselves, $\log 32\cdot4 = 1\cdot5105$, $\log 3\cdot24 = \cdot5105$, $\log \cdot324 = \bar{1}\cdot5105$, $\log \cdot0324 = \bar{2}\cdot5105$. All this is done quickly, and may ultimately be dispensed with.

*Ex.* 2.—Find the value of $(\cdot0324)^3$.

According to the rule for powers, multiply $\log \cdot0324$ by 3. (Remember that in $\bar{2}\cdot5105$ the $\cdot5105$ is *positive* and the 2 is *negative*.) Doing this in the ordinary way, we get $\cdot5315$ and $1$ to carry; then *three times* $\bar{2}$ gives $-6$, and $+1$ to carry gives $-5$, or $\bar{5}$, and the result is $\bar{5}\cdot5315$. Now 5315 will be found in the table to be the log of 3400 (that is, $\cdot5315$ is $\log 3\cdot4$), so that by working backwards, shifting the decimal one place at a time, and subtracting 1 from the logarithm each time, we find that $\bar{5}\cdot5315$ is the log of $\cdot000034$, therefore $(\cdot0324)^3 = \cdot000034$.

*Ex.* 3.—Raise $\cdot324$ to the power $-1\cdot8$; that is, find the value of $\cdot324^{-1\cdot8}$.

Proceeding as before, multiply $\log \cdot324$ by $-1\cdot8$; that is, multiply $\bar{1}\cdot5105$ by $-1\cdot8$. In doing this, multiply $+\cdot5105$ by $-1\cdot8$; the answer is $-\cdot9189$. Now multiply 1 by $-1\cdot8$; the answer is $+1\cdot8$. Now combine $1\cdot8$ and $-\cdot9189$; the result is $\cdot8811$, and this is the log of $7\cdot605$; hence $7\cdot605$ is the final answer.

*Ex.* 4.—Find from the tables the logarithm of $\sin 50° 18'$.

The value of $\sin 50° 18'$ is found from the tables to be $\cdot7694$, and the logarithm of $\cdot7694$ is $\bar{1}\cdot8861$; therefore the logarithm of $\sin 50° 18'$ is $\bar{1}\cdot8861$.

But you will find from the table giving logarithms of sines that $\log \sin 50° 18'$ is given as $9\cdot8861$. You have therefore to understand that because it is considered inconvenient to print the *minus* in $\bar{1}\cdot8861$, it is agreed to increase all the real logarithms of sines, cosines, tangents, etc., by 10, and print the increased values. Hence when we take the log of a sine, cosine, or tangent from the tables we must *always diminish it by 10*.

*Ex.* 5.—Find the value of $\sqrt[3]{\sin 50° 18'}$.

The value of $\sin 50° 18'$ is $\cdot7694$; we require $\sqrt[3]{\cdot7694}$, which is the same as $(\cdot7694)^{\frac{1}{3}}$.

Now $\log \cdot7694$ is $\bar{1}\cdot8861$; to divide this by 3 add $-2$ to the negative part and $+2$ to the positive part, so that we get $\bar{3} + 2\cdot8861$, which, when divided by 3, gives $1\cdot9620$. This is the log of $\cdot9164$, hence $\cdot9164$ is the answer.

We might, however, take the value of $\log \sin 50° 18'$ from the tables at once; this is $9\cdot8861$ diminished by 10, or $\bar{1}\cdot8861$ as before.

*Work the following:*—

Find the values of

(1.) $\dfrac{294\cdot6 \times \cdot9854 \times 2\cdot718}{21\cdot34 \times \cdot0927}$. Ans. $398\cdot8$.

(2.) $\sqrt[3]{645\cdot3}$; $1 \div (1\cdot44)^3$. Ans. $8\cdot642$; $\cdot3349$.

(3.) $\dfrac{\sin 32° 18' \times \cos 56° 54'}{\tan^2 20°}$. Ans. $2\cdot203$.

(4.) $b \sin A \div \sin B$, if $b = 20$ A $= 34°$, B $= 46°$. Ans. $15\cdot55$.

(5.) $\sqrt{\dfrac{(s-a)(s-b)}{ab}}$ if $2s = a + b + c$ and $a = 20\cdot4$, $b = 70\cdot89$, $c = 65\cdot82$. Ans. $\cdot5550$.

## Stage 3.

### *Algebra.*

*Permutations and Combinations.*—Hall and Knight's *Higher Algebra*. The principle stated in Art. 140 is of fundamental importance. A student who fully grasps its meaning will be able to work many examples. There are three formulæ which

should be well known, since little can be done without them. These are: 1. The two established in Art. 141—namely, ${}_nP_r = n(n-1)(n-2)\ldots\ldots(n-r+1)$, and ${}_nP_n = \lfloor n$; 2. Formulæ 1 and 2 in Art. 144; 3. The formula of Art. 151.

Arts. 152, 153, and 156 are useful.

*Work* Ex. xi.(*a*), Nos. 4, 7, 11, 13, 25, 29; Ex. xi.(*b*), Nos. 4, 5, 6, 10, 16, 24.

Todhunter and Loney's *Algebra.*—The formulæ in blacker type on pages 341, 342, 343 are essential. Read carefully through all the worked-out examples.

*Work* Ex. civ., Nos. 3, 5, 11, 18; Ex. cv., Nos. 1, 10, 18, 19, 20, 24, 39.

*Intermediate Algebra.*—*Read* the fundamental principle stated in Art. 288, and the worked-out examples of Arts. 287 to 292. The formulæ of Arts. 295, 297, 305, 307 are often required.

*Select* and *work* examples from the 100 to be found in chap. xxii.

*Trigonometry.*

*Properties of Polygons.*—In addition to knowing, and being able to establish, the formulæ for the radii of the inscribed, circumscribed, and escribed circles of a triangle, the following should also be considered; they will be found in most of the text-books of trigonometry:—

1. The sides and angles of the triangle whose angular points are the centres of the three escribed circles.

2. Lengths of the lines drawn from the angular points to the centre of inscribed circle.

3. Expressions for lengths of perpendiculars from angular points on to opposite sides.

4. Expressions for length of a tangent from the corner A to the inscribed and escribed circles.

5. Perimeters and areas of regular polygons inscribed in or circumscribed about a given circle.

6. Expressions for the area of *any* quadrilateral, and what this becomes if the quadrilateral can have a circle inscribed in it or circumscribed about it.

*Work the following:*—

1. Show that $pa = qb = rc$; $p$, $q$, $r$ being the lengths of the perpendiculars from the angular points of the triangle upon the opposite sides.

2. Show that

$$\frac{b\cos C + c\cos B}{\sin A} + \frac{c\cos A + a\cos C}{\sin B} + \frac{a\cos B + b\cos A}{\sin C} = 6R.$$

3. Show that $a^2 - b^2 = 2Rc\sin(A - B)$.

4. Show that $DE = c\cos C$, and $DFE = \pi - 2C$; D, E, F being the feet of the perpendiculars from angular points upon the opposite sides.

# NOTES ON THEORETICAL MECHANICS.

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## ADVANCED AND HONOURS STAGES.

*Moment of Momentum.*—If any particle of mass $m_1$, at distance $r_1$ from axis of rotation, has momentum $m_1v_1$, its moment about the axis is $m_1v_1r_1$; and, therefore, moment of momentum $= \Sigma mvr = \omega\Sigma mr^2 = \omega I$.

A body moving in a straight line under the action of a constant force, acceleration $= \frac{\text{force}}{\text{mass}}$. For a rotating body, angular acceleration $= \frac{\text{couple}}{I}$.

We can best illustrate these formulæ by examples.

Ex. 1. A uniform rod of mass M, length $l$, and turning freely about a centre at O, is allowed to fall from a horizontal position OB; find its angular velocity when in a vertical position at OC.

Here the acting force is the weight of the rod $Mg$, acting at a distance $\frac{l}{2}$ from O.

If $\omega$ be the angular velocity of the rod at C, then

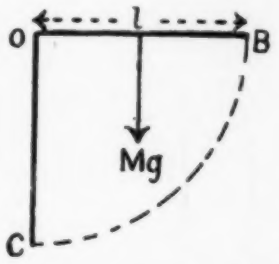
$$Mg \times \frac{l}{2} = \tfrac{1}{2}\omega^2 I.$$

But I for a rod about an axis through one end at right angles to its length is $\frac{Ml^2}{3}$.

$$\therefore Mg\frac{l}{2} = \tfrac{1}{2}\omega^2\frac{Ml^2}{3}.$$

$$\therefore \omega^2 = \frac{3g}{l}, \text{ or } \omega = \sqrt{\frac{3g}{l}}.$$

Let the length of the rod be 10 feet; its weight 50 lbs. ($g = 32$); find $\omega$. Ans. $\omega = \sqrt{\frac{96}{10}} = 3{\cdot}09$.




Ex. 2. A uniform rod, length $l$, mass M, rests on two supports, one at each end. If one of the supports be suddenly removed, show that the pressure on the remaining instantly becomes one-half of its previous amount.

Ex. 3. Draw ABC an equilateral triangle, with the base AB horizontal, and C downwards; let a weight at C be tied by threads AC, BC to fixed points at A and B: if the thread BC is cut, show that the tension of AC is suddenly increased by one-half. (1895.)

Ex. 4. A particle whose mass is $2m$ is placed on a horizontal table, and is connected by a thread to a particle whose mass is $m$, which hangs over the edge; there is no friction. At first the particles are kept from moving; when motion is allowed to take place, find the tension of the thread; find also the change in the pressure on the edge of the table which takes place as soon as the motion begins. (1898.)

Ex. 5. Write down the formulæ for uniformly accelerated motion, and establish the equation of energy.

A string a foot long has one extremity attached to a fixed point, and the other loaded with a heavy particle: the particle being dropped from the position in which the string is taut and horizontal, find its velocity when the string is inclined to the horizontal at an angle of 30°. (1898.)

Ex. 6. Two particles whose masses are $m$ and $n$ are connected by a thread which passes over a point (as in Atwood's machine); during the motion there is a given friction $f$ between the thread and the point: if $m$ falls and draws $n$ up, find the tensions of the parts of the thread. (1898.)

FLUIDS.

The definitions of solids and fluids should be carefully made out. The following may be useful:—

A *solid* is a portion of matter or a body having *size and shape.*

A *liquid* is also a body having *size, but not shape.*

A *gas* has *neither size nor shape.*

The two latter are often included in the term "fluids."

A *solid* offers resistance to any change of shape.

A *fluid* offers no resistance to change of shape. In the case of liquids, although the shape assumed will be that of the containing vessel, the volume cannot be sensibly altered. *Liquids are* therefore said to be *incompressible;* the surface of the liquid not in contact with the sides of the vessel is called the *free surface. Gases are compressible,* entirely filling any closed vessel in which they are placed; hence *gases have no free surface.*

A liquid in contact with a surface behaves as if it were composed of very hard and minute spheres; the force exerted by it on the containing surface is at every point perpendicular to the surface, and the pressure is often referred to as the *thrust* of the liquid.

The *pressure is the intensity of the thrust per unit area.*

The *pressure at a point* is a term used to indicate *the actual pressure on a small area enclosing the point.*

*Whole Pressure.*—If A is the area of a plane surface immersed in a fluid, the whole pressure on it, neglecting the pressure at the surface, is equal to $w\bar{z}A$, where $w$ is the weight of unit volume of the liquid, and $\bar{z}$ is *the depth of the centre of gravity* of the surface below the free surface of the liquid.

If we consider any small element $a_1$ of the surface at a depth $z_1$ from the surface, the pressure on such an element is the weight of a prism of liquid area of base $a_1$, height $z_1$; $\therefore$ volume $= a_1z_1$, and weight $= wa_1z_1$.

In a similar manner, if $a_2$, $a_3$ ..... be other elements of the

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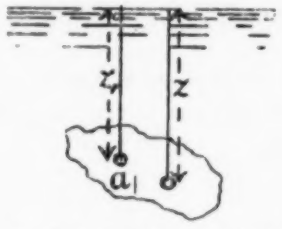
plane surface at depths $z_2$, $z_3$ ....., the weights and therefore pressures on them are $wa_2z_2$, $wa_3z_3$ .....

Hence the whole pressure $= w[a_1z_1 + a_2z_2 + a_3z_3 + .....]$.




But if $z$ be the depth of the centre of gravity of any plane area,

$$\bar{z} = \frac{a_1z_1 + a_2z_2 + a_3z_3 + .....}{a_1 + a_2 + a_3 + .....}.$$

Or better, $\bar{z} = \dfrac{\Sigma(az)}{\Sigma(a)}$.

$\therefore \bar{z} \times \Sigma(a) = \Sigma(az)$, or $\bar{z}A = \Sigma(az)$.

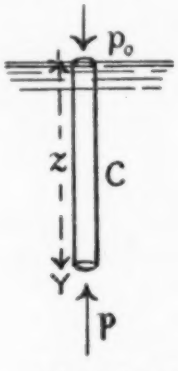
Hence total pressure $p = w\bar{z}A$. (1)

The *whole pressure* on a given surface is the sum of the pressures on each element of area, and is *equal to the number of units of area of the surface, multiplied by the number denoting the depth of the centre of gravity of the surface, and by the weight of unit volume* of liquid.

The area and depth should, of course, be expressed in the same units (inches, feet, or centimetres).

The proof given equally applies when the area is not plane.

Consider the equilibrium of a small cylinder or prism of liquid, area of base A, depth $z$, the upper end of the cylinder in the surface of the liquid. The downward forces acting on the cylinder are its weight $wzA$, and the atmospheric pressure $p_o$; as the cylinder is in equilibrium, these downward forces are balanced by the upward pressure of the liquid $p$A.




Hence $pA = wzA + p_oA$.

$\therefore p = (wz + p_o)$. (2)

Eq. (2) gives the pressure at any point, and since $p_o$ is constant, it also proves that the pressure is directly proportional to the depth of the point when $p_o$ is neglected. This reduces to Eq. (1).

*The intensity of pressure is the same at all points of a horizontal surface.*

The pressure at any two points is given by

$$wz + p_o = wz_1 + p_o. \quad \therefore z = z_1,$$

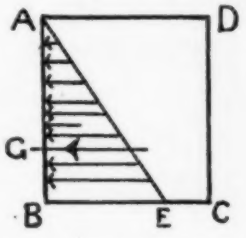
on the assumption that the atmospheric pressure is the same on all parts of the surface, which is obviously the case when the area under consideration is not large.

It will be seen that Eq. (1) may be briefly written

$$\Sigma wz\,\delta A = w\bar{z}A.$$

*Resultant Pressure.*—In the case of a plane surface, the pressures on the elements of the surface will form a system of like parallel forces; and as the resultant of such a system is a force equal to their sum, the whole pressure is equal to, and coincides with, the resultant pressure.

*The centre of pressure* is the point in the area at which the resultant pressure acts. The pressure on the vertical side AB of a vessel filled with water consists of a large number of like parallel forces. At the surface the pressure is zero; at B the pressure is due to depth of B below the surface. Hence if BE be made to some convenient scale to denote the pressure at B, and E be joined to A, the pressure on the side AB may be represented by the triangle AEB; and the centre of pressure is coincident with the centre of gravity of the triangle, and is therefore at a point G, where BG is $\frac{1}{3}$ BA.




**Ex. 1.** Two circles are drawn on a vertical wall of a reservoir; they touch each other externally, and the centre of one is vertically below the centre of the other. The water in the reservoir rises so that the upper circle is just immersed. Find the ratio of the radii when the resultant pressures on the two circles are equal. (1895.)

Solution:—

Let R denote the radius of the upper circle; let $r$ denote the radius of the lower circle.

Pressure on the upper circle $= \pi R^2 \times R \times w$.

Pressure on the lower circle $= \pi r^2 \times (2R + r)w$.

But the resultant pressure on the upper circle is to be equal to that on the lower.

$$\therefore \pi R^3 \times w = \pi r^2(2R + r)w,$$

$$R^3 = r^2(2R + r). \quad (1)$$

Eq. (1) may be written in the form

$$(R + r)(R^2 - Rr - r^2) = o. \quad (2)$$

Thus either $R + r = o$, or $R^2 - Rr - r = o$.

The former assumption is clearly impossible,

Hence $R^2 - Rr - r^2 = o$,

or $$R^2 - Rr + \left(\frac{r}{2}\right)^2 = r^2 + \frac{r^2}{4} = \frac{5}{4}r^2.$$

$$R = \frac{\sqrt{5} + 1}{2}r,$$

$$\therefore \frac{R}{r} = \frac{\sqrt{5} + 1}{2}.$$

**Ex. 2.** Let AB be the radius of a (solid) hemisphere at right angles to its base; let the hemisphere be held under water so that the centre (A) is at a depth below the surface equal to the radius: find the whole pressure of the water on the hemisphere, (*a*) when B is vertically above A, (*b*) when B is vertically below A. What would be the resultant pressure of the water in both cases?

(*N.B.*—The centre of gravity of the curved surface of a hemisphere is at a distance of half the radius from the centre.)

Solution:—

(*a*) If $r$ denote the radius of the hemisphere: as area of curved surface $= 2\pi r^2$, and depth of centre of gravity is $\frac{r}{2}$,

$\therefore$ total pressure on curved surface $= 2\pi r^2 \times \frac{r}{2} \times w$

$= \pi r^3 w$.

Area of flat portion $= \pi r^2$; depth of C.G. $= r$.

$\therefore$ Total pressure on flat surface $= \pi r^2 \times r \times w$

$= \pi r^3 \times w$.

$\therefore$ Total pressure on hemisphere $= (\pi r^3 + \pi r^3)w$

$= \underline{2\pi r^3 w}$.

(*b*) Total pressure on curved surface $= 2\pi r^2 \times \frac{3}{2}r \times w$

$= 3\pi r^3 w$.

Total pressure on flat surface $= \pi r^3 w$.

$\therefore$ Total pressure on hemisphere $= \underline{4\pi r^3 w}$.

The resultant pressure of the water in both cases is the weight of water displaced by the solid, less the weight of the solid.

$\therefore$ Resultant pressure $= \underline{\frac{3}{4}\pi r^3 w - mg}$.

*(To be continued.)*

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***For particulars of Contents, see page lxxii.***

# OUR COMPETITION PAGE

## OUR FRENCH AND GERMAN PRIZE COMPETITION.

*Prize Editor*—W. T. THOMPSON, B.A. (LOND.), *French and German Honours.*

### RULES.

1. All translations should be posted not later than March 8, and addressed:—*Prize Editor*, Office of THE PRACTICAL TEACHER, 33 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should adopt a pseudonym, and send name and address written on a separate piece of paper.
4. No competitor may take the prize offered more than once in three months.

### RESULT OF THE JANUARY COMPETITION.

THE prize is awarded to *Eicarg*, the pseudonym of G. Masson, 36 Comiston Drive, Edinburgh.

*First Class.*—Prigione, C.E.M., Spes, M.F.C., Polly, Moorland, Cymru, Beth, Nancy, Lisette, Adohr, Sunt lacrymæ rerum, Josephine, Dies, Fido, Munische, Rus, Christmas Rose, Allez, Professeur, Cestrian, Uleg, Va-de-bon-cœur, Avondale, Augustine, Immacolata, R.F.F.

*Second Class.*—Pen, Vera, Desdichado, Braxet, Festiniog, Helier, J'espère, Gleaner, Manu forti, Meg, St. Swithin, Sally, Gautier, Subscriber, Rosine.

We regret that, owing to the demands on our space this month, we are unable to publish Eicarg's translation.

The competition produced some very good translations, although the length of the piece probably operated in considerably reducing the number of those who entered. With the exception of several faults of scansion, Eicarg sent in a very good and faithful rendering of the piece. Besides the successful competitor, only C.E.M. and R.F.F. sent in verse translations. In classifying competitors, in addition to the marks given for the general fidelity of the translations, additional credit was given to those who were most successful in preserving the simplicity, directness, and sincerity of old Jean's account of his crime. The text did not present many special difficulties. The negative meaning of *plus d'ouvrage* escaped a good many competitors, and some translated *salaire* by "salary." A few took *Je n'ai pas fait de barricades* in a figurative sense, and translated it, "I am not an obstructionist;" "I have made no hindrances;" "I did not make any excuses," etc. (*Je*) *me méfie un peu Des habits noirs pour qui l'on fait le coup de feu* expresses, of course, the workman's opinion that it is only those of a higher rank in society than his own who profit by the revolutions in which he sheds his blood. Failure to comprehend this produced some very fanciful renderings. "I am rather bashful in the black clothes one uses to wear by the forge," and "I do not care to disguise real reasons under false ones," represent the boldest flights of fancy in dealing with this sentence. The most difficult passage in the poem was that commencing with the line *Je ne prétends pas qu'il faille tenir compte*, and ending with *pensée*. Rejecting attributes, the key to the meaning may be found by taking together *Je ne prétends pas qu'il faille tenir compte même au désespéré—de n'avoir jamais eu de coupable pensée. Comme des bourgeois* produced some very literal translations. *Bourgeois* was rendered "middle-class people," "townsfolk," and "citizens." Better translations were, "like the gentry" and "like our betters."

### FRENCH COMPETITION.

**A Prize of One Guinea** will be given for the best translation into English of the following extract:—

Voltaire était plûtot malicieux que méchant, plûtot indiscipliné que factieux, plûtot relâché que corrompu; parmi tous les caprices de son esprit, les témérités de sa raison, les inégalités de son humeur, il avait de généreuses passions: il aimait la gloire, il fut sensible à l'amitié, l'injustice le révoltait, et pour redresser les torts de la violence et du fanatisme, on l'a vu braver et irriter courageusement la colère des violents et des fanatiques.

Soyons juste envers Voltaire; s'il a dans sa vie une de ces taches qui ne s'effacent point, et des torts qu'on ne doit ni oublier ni pallier, il a aussi des titres incontestables qui ne permettent pas qu'on l'abandonne sans réserve aux représailles de ceux qu'il a vaincus. Comme son siècle, il a eu dans la guerre contre le passé ses ruses déloyales, ses emportements, ses ingratitudes. Il a été au delà du but; mais l'ardeur qu'il ne sait pas toujours maîtriser ne l'entraîne pas à tous les excès; il s'arrête avec respect devant la noble figure de Saint Louis, malgré sa haine pour le moyen âge; il glorifie Henri IV., il honore Louis XIV. au delà même de ses mérites; il reste fidèle à la religion littéraire du siècle précédent; il défend la civilisation contre les chimères d'innocence et de pureté barbares écloses du cerveau de Jean-Jacques; il renvoie avec dédain et colère le brevet d'athéisme que lui décernent les d'Holbach et les Lamettrie, et il ne se laisse pas déconcerter par les railleries des Grimm et des Diderot qui lui reprochent comme une faiblesse de tenir encore à son Dieu "rémunérateur et vengeur." En parlant d'un tel homme, il y a certainement un milieu à garder entre l'anathème et l'apothéose. EUGÈNE GÉRUZEZ.

### GERMAN COMPETITION.

**A Prize of Half a Guinea** will be given for the best translation into English of the following extract:—

Nicht eine Sekunde dieser köstlichen Wochen ist mir verloren gegangen. Ist doch Reisen an und für sich etwas Entzückendes. Den Staub des Alltagsleben schüttelt man von sich, alles Gewöhnliche und alles Gewohnte lässt man hinter sich und geht Neuem entgegen. Wie ist das überwältigend, wenn man so früh morgens eine Wanderschaft antritt, hinein in den knospenden Tag, als winke einem die erste Jugend mit ihrer Sonne und ihrer Reichtum! Die Welt erscheint einem in berückendem Zauberlichte. Man wandelt auf den Spuren des Grossen und Schönen, wird selber gross und schön, die Schauer der Vergangenheit umwehen uns, und mächtige Gestalten der Vorzeit schliessen sich uns an auf unserem Wege. Es ist, als sei die Erde eine Wandeldekoration, die an dem freudetrunkenen Auge des Betrachters vorüberzieht; man möchte in die Hände klatschen und den erhabenen Regisseur hervorrufen, der das alles in Scene gesetzt hat. Noch habe ich in meinem Kopfe nicht alle die Bilder geordnet, manchmal verschwimmen sie mir ineinander: Verona, Florenz, Rom.....Aber am schönsten hat sich mir das Bild von Venedig erhalten. FERDINAND GROSS.

### EASTER HOLIDAY TOURS.

MESSRS. Thomas Cook and Son, the well-known tourist agents, have sent us from their chief office at Ludgate Circus a copy of their *Excursionist and Tourist Advertiser* for February. This journal, which appears in a new form, is beautifully illustrated, and contains the fullest particulars relating to tours in all parts of the globe. What will, however, be of especial interest to our readers at the present moment is the list of EASTER HOLIDAY TOURS. This contains information concerning short excursions to Antwerp, Brussels, Holland, etc., as well as of the more extended tours to Rome and various parts of Italy, the South of France, Egypt, Spain, Morocco, etc.

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# THE EDITOR'S TABLE

## READING AND RECITATION.

### NEW GUIDES AND NEW BOOKS FOR PRACTICE.

OWING to the special importance attached to different kinds of knowledge by different writers on the education of the people, there has long been a tendency to increase the number of subjects required to be taught in schools, and the result has been a steadily-growing demand on the part of those who take a thoughtful all-round view of the matter for a simplification of the curriculum. It is very certain that, with the necessary and reasonable limitation of school hours, and with the natural limits of children's powers of mental assimilation, new branches of instruction cannot be introduced except at the risk of displacing some of the old ones; and it is beginning to be felt that the multiplication of practical subjects, the value of which it is not difficult to maintain, is already diminishing the attention paid to what is called the literary side of education, which has considerable claim to be regarded as the refining and formative element in mental equipment.

Still, in the fact that reading is in so special a sense the key of knowledge, there is a certain security against that subject being ousted from the very prominent place it has hitherto occupied in the curriculum of every primary school. The extensive array of reading books and books on reading which has recently accumulated on our table, affords evidence not only that the scholastic publishers are convinced of the continued importance of reading, but that they and the writers of school books are fully alive to the need for the utmost possible improvement in the books they provide for school use, and for the maximum of helpfulness in the guides they produce for teachers.

#### Early Stages of Reading.

As the adoption of the most effective method of teaching is the surest way of securing economy of school time, it is not surprising that much attention is devoted to the devising of plans for overcoming the initial difficulties of teaching children to read. The all-pervading irregularities of English orthography form special inducements to teachers to seek for means of rendering easier the earliest steps in reading. Some try the Phonetic method, the strict use of which involves the relegation of many of the commonest and shortest words to a rather late stage, because their pronunciation is so utterly contrary to all sound-analogies. Some resort to the use of a phonetic alphabet with modified spelling as a temporary help till some of the difficulties are surmounted, and then take up the ordinary spelling.

A short time ago we noticed a beginner's book called the *Reformed Reading Primer*, by Dr. Leftwich, in which, by means of diacritical marks in connection with the letters, the inventor of the system seeks to indicate clearly the sound-value of each letter. We have before us a pamphlet on this system, entitled *A Reformed Alphabet designed to facilitate the Art of Learning to Read*, by R. W. Leftwich, M.D. (Sir Isaac Pitman and Sons). In a few pages the system is described and its advantages are set forth; among these it is claimed that by its use "a child may be taught to read in one-third the time required at present." This claim, of course, can only be verified by full experiment; but to us it appears that the multitude of diacritical digits introduced must be bewildering to young children.

Among the most helpful plans for facilitating early instruction in reading we are inclined to place the application of the method of word-building on the principles of similarity and contrast. This, which may be regarded as a combination of the Look-and-Say method with a modified form of the Phonetic, doubtless received a considerable impetus from the requirement of word-building as a subject of instruction. Several Primers and Infant Readers are so constructed that this plan may easily be applied to them. We may mention especially the early numbers of *Nelson's Royal Crown Series* and *Blackie's Sight and Sound Primers*.

#### Special Reading Books: Historical.

Assuming that the first steps are successfully achieved, it may further be taken for granted that the best means of securing improvement in the more advanced stages of reading is by abundant intelligent practice carefully and watchfully directed. And the practice is all the more likely to be intelligent if the matter of the exercises possesses definite and sustained interest. On this ground we would strongly uphold the use of the special reading books designed to be auxiliary to the teaching of such class subjects as history, geography, elementary science, and domestic economy. These, when compiled on a judicious plan and written in a simple and pleasant style, are helpful not only for the practice they afford, but also for the revelation they bring of the real utility of reading as the means of acquiring new knowledge and of becoming acquainted with the thoughts and ideas of great minds.

No subject lends itself more readily to effective treatment in class reading books than history; and we feel bound to dissent entirely from an opinion we heard expressed at a recent conference, on the question of teaching history, to the effect that poor results from the use of historical reading books are due to the worthless character of most of the books available. Among the early series produced to meet the requirements of the Code were doubtless to be found some hastily compiled, or adapted from older works, which erred on the side of being either too heavy or too flowery and vague. Many of the more recent series are, however, free from these defects, and may well serve useful ends as affording trustworthy guidance in acquiring an elementary knowledge of history, and as a valuable stimulus to the intelligent practice of reading.

Let us now turn to some of the volumes which await our notice, and the presence of which has suggested these introductory remarks.

First we take up *The Patriotic Historical Readers, Books I. and II.* (William Collins, Sons, and Co., Limited). These contain simple stories prettily written, well printed in bold type, and abundantly illustrated. Among the stories are several which learned historians are apt to regard as mythical, but we welcome their retention in books for young children, even if we have later on to reject some of them as having only the same sort of truth as fairy-tales.

The illustrations are a striking feature, a large proportion of them being full-page coloured plates; but these, as well as the pictures in black and white, appear to us unequal, some being rather crude, while others are artistically designed and delicately reproduced in a good form of colour-printing. "Queen Elizabeth riding through London" we think a very effective picture; and the first black-and-white picture in Book I. is a very pleasing reproduction from a photograph—"Tell me a Story." It seems rather strange to see portraits of Queen Elizabeth and Mary Queen of Scots "from photos by Valentine and Sons;" but we must understand that the photos are from historical paintings or engravings. The books may be confidently recommended for adoption.

*The Waverley Historical Readers, Books II. and III.* (M'Dougall's Educational Company, Limited), are adapted to Scheme A of the Code. The second book begins with three lessons on "How America was Found," and ends with three on "The British Navy." The latter are capitally illustrated by pictures of ships of various periods, from "A Saxon Warship" to "A Modern Ironclad."

Book III. treats, in a more detailed style, the history of England from the earliest times to the battle of Bosworth. The lessons are well proportioned, so as to devote most space to the lives and events most likely to interest children. Both books are suitably illustrated, all the pictures being in black and white except the frontispiece in each. The type and paper are excellent.

The Historical Readers which remain to be noticed are for the upper standards. They include *Chambers's Alternative History Readers for Standards VI. and VII.* (W. and R. Chambers, Limited). Of these, the first consists of a series of interesting chapters on the reign of Queen Victoria. A number of excellent

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portraits of the men who have adorned the Victorian era, and a few other illustrations, add to the educational value of this volume.

The book for Standard VII. has for its subject "Greater Britain: Its Rise and Growth." The lessons are arranged in sections, which treat of our colonies in North America, British India, Australasia, and Africa. Several maps are introduced, and a few good illustrations. The style is interesting, and well adapted to the class of children for whom the book is intended.

In the final volume of *The Raleigh History Readers* (Blackie and Son, Limited), intended for Standard VII., we have another work on the same subject—"The Growth of Greater Britain: A Sketch of the History of the British Colonies and Dependencies," by F. B. Kirkman, B.A. This sketch is really a brilliant piece of educational work; and the elder schoolgirl or schoolboy who reads it thoughtfully is likely to gain a new idea of the value and interest of historical study. The author very properly groups the striking events of which he writes about the lives of the great seamen, adventurers, colonisers, and commanders whose courage, perseverance, foresight, and deeds of personal prowess have had so large a share in building up our great empire. The wonderful story is told in a manner worthy of the subject and of its intense interest.

At the close of the volume are to be found two or three noteworthy features: first, a "general summary" of the sixty-eight chapters which form the body of the book, a few pages of explanatory notes, tables of the colonies and dependencies, including the acquisition in 1898 of Wei-hai-wei by lease, and of the Santa Cruz Islands by annexation; and, lastly, two valuable sections on Bibliography, in the shape of a list of story books dealing with colonial history, and a list of colonial histories, biographies, and books of travel.

We feel that we cannot too highly commend this book. Where it cannot be used as a class reading book, it might well be added to the school library.

*The St. George History Readers, Book VII.* (T. Nelson and Sons), is a history of Great Britain and Ireland from the Union of the Crowns, by G. W. Prothero, M.A., Litt.D. It is written in a bright, clear, and attractive style which carries the reader on easily from point to point. The accounts of wars and battles are elucidated by many maps and plans, and the great men of thought and action are kept constantly in mind by the very numerous selection of portraits. Of special interest are the chapters in which Dr. Prothero reviews the trade, industry, and literature of the seventeenth century; society, art, and literature in the eighteenth; and the literature of the nineteenth century. The last of these, which forms the sixtieth chapter of the volume, contains eighteen portraits of eminent writers.

The book is beautifully printed, and brings an admirable series to a worthy conclusion.

## Geographical Readers.

Of Geographical Readers the number goes on increasing, but it is a more satisfactory matter that an examination of those more recently issued seems to afford ground for the belief that they are improving also. Certainly several of the later series are very different from the earlier books, which consisted in some cases simply of the matter usually tabulated in text-books of geography, rearranged and printed in the form of paragraphs. Now we oftener have passages of lively description and of thoughtful comparison, with accounts of travel and adventure, and the modes of life in remote countries. The influence of climate and other natural conditions on productions, on industry, on trade, and on national characteristics, affords abundant material for reading lessons of a most attractive and instructive kind.

A truly excellent introduction to the subject of geography is Book IV., the first issued of a new series called the *Royal Osborne Geography Readers* (Thomas Nelson and Sons). Its special title, *Sea and Land*, indicates that it deals chiefly with the elementary physical features of the earth, which is our common home as long as our mortal life endures. By the use of simple, well-chosen language, by frequent reference to familiar experiences, by occasional anecdotes, and abundant pictorial illustrations, the young reader is led on to take an intelligent interest in such matters as the roundness of the earth, the horizon, the sea, its shores, cliffs, sands, its inhabitants, its dangers, lighthouses, lightships, buoys, the rocket brigade, fishing, waves, the tide. Then the dry land is similarly described, from the soil to plains, hills, mountains and their phenomena, clouds, snow, glaciers. Full of lessons as interesting as the chapters of a story, the book is one we can confidently recommend for any school in which the systematic teaching of geography begins in Standard IV. or its equivalent class. It is further recommended by its very neat and substantial form.

*Chambers's Alternative Geography Readers*, of which we have before us the books for Standards VI. and VII., exhibit in a striking degree the excellent features outlined above. Standard VI. treats of the Great South Land, the Great Dominion, British South Africa, and India; and the various lessons form an admirable commentary on the fine sentence of Carlyle which has been chosen for an introductory motto. Several of the lessons are all the more impressive from being given in the form of personal experiences in tours and travels. They are illustrated by ten maps and a number of views and woodcuts of animals.

Standard VII. of the same series takes up pretty much the same ground—the British Colonies and Dependencies. The lessons, however, are quite different, the early ones describing the overland route to India, followed by visits to the cities of our great Asiatic empire. Then Australia is visited, and we have peeps at New Zealand, and afterwards a voyage to Canada, a series of chapters entitled "Ocean to Ocean by Rail," and another series on the interchange of productions. The bright, lively style in which these are written must prove a great help to maintaining interest and impressing the minds of the pupils.

## Science Readers.

One effect of the increased encouragement given in recent years to the teaching of elementary science and object lessons as class subjects in Government schools has been the publication of several series of reading books on these subjects. Some of the earlier books had the defect of being too much like outline notes of lessons somewhat expanded, so that a reading lesson consisted merely of a string of sentences constructed to state in succession the various points of an oral lesson. In many cases, however, the difficulty of presenting simple teaching on scientific subjects in the form of reading lessons has been skilfully overcome, and samples of books worthy of unstinted praise now lie before us.

*Moffatt's Science Reader II.* (Moffatt and Paige), professing to be "a series of simple object lessons," is really a capital set of pleasant readings, chiefly on natural objects with the appearance of which most children have opportunities of being familiar. The lessons are marked by great variety in the form of expression, from direct statement and description to the anecdote and narrative and the free exclamation so natural to children on seeing something wonderful or curious. The book is beautifully printed and suitably illustrated. The coloured frontispiece is very pleasing, and shows in one picture the primrose plant, the frog, the toad, the snail, and some other objects naturally grouped.

*The Newton Science Readers, Third Book* (Blackie and Son, Limited), by W. Furneaux, exhibits considerable variety in the subjects chosen from animal life, plant life, and common substances, and also in the mode of treating them. Careful scientific method is, however, everywhere evident; and it is surprising how fascinating reading lessons of this kind can be made when the best lines are followed. Simple trains of scientific reasoning about natural objects afford excellent practice in reading with due emphasis and expression, and such lessons are likely to stimulate a wholesome curiosity with regard to nature and life that surrounds us. The illustrations in colour and black and white are numerous and effective; and the summaries of the lessons at the end would form admirable brief notes for oral lessons.

With Book VII. Mr. Murché brings to a close his admirable series of *Domestic Science Readers* (Macmillan and Co., Limited). The artifice of presenting the lessons in the form of extended reports of simple lectures on the subjects, and conversations thereon among young students, is in this volume, as in previous ones, much used, and the adoption of the plan finds ample justification in the skilful and successful manner in which it is carried out. To the preface, in which the author explains the scope and purpose of the book, is added a short commendatory preface from the hand of Mrs. Burgwin. The first part treats of the laws of health, and later sections of infant management, common ailments, common accidents, infectious diseases, and the sickroom. The paper, printing, illustration, and binding of this book, as of the whole series, are thoroughly good.

Another series of Science Readers is completed by the publication of *Lessons on Living* (Blackie and Son, Limited), a reading book in physiology and hygiene, for Standards VI. and VII., by H. Rowland Wakefield. The lessons are given in the form of a continuous tale, which narrates the doings of two brothers, Arthur and Harry Cottrell, and introduces many lively conversations on the laws of health and on the dwelling and its essential features. The book is one to be heartily commended.

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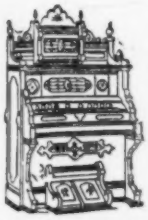

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practice, we should be very sorry to see them entirely supplant the books whose contents are drawn from literary sources, and which, for the sake of distinction, may be called Literary Readers.

One variety of the latter kind we are particularly glad to see multiplying; we refer to those which have a continuous thread of interest, such as school editions of the works of standard authors, abridged where that may be necessary to make them of suitable length for class reading. Among these we may name Messrs. Longmans' series of Supplementary Readers, including selections from Mr. Andrew Lang's *True Story Books*, and a school edition of Mr. Conan Doyle's *Micah Clark;* Macmillan and Co.'s abridgments of Kingsley's *Westward Ho* and Miss Yonge's *Lances of Lynwood;* T. Nelson and Sons' school edition of *The Coral Island;* and shortened editions of some of the most popular books by Sir Walter Scott, Captain Marryat, and Charles Dickens, published by other firms.

Such books as these are, of course, suitable for use only in the higher standards; but even in the lower standards, where the lessons must be easier and shorter, it is possible and desirable to have reading of selections of good literary quality. As a favourable sample of a good series we may refer to one just received, *The Ideal Reader, Book III.* (Sir Isaac Pitman and Sons, Limited). Its contents include a number of stories, subdivided, according to their length, into five or six sections. Some of the pieces are adapted from Hans Andersen and Grimm, and others are from recent English and American authors. They are all well suited for use in the third standard. The paper, print, and most of the illustrations are thoroughly worthy of commendation.

*Legends of Greece and Rome: Stories of Long Ago* (Isbister and Co., Limited), by Grace H. Kupfer, is a high-class reading book which appears to be of American origin. It contains many of the old classical myths charmingly rendered in simple, fluent English. We have heard it said that children in the common schools of America are far more generally acquainted with the names and characters in ancient history and mythology than the children in English schools; and if such books as this are in general use in the States (and it is by no means the first we have seen of its kind), the statement is quite intelligible. Poems suggested by the subjects of the stories are interspersed, and the volume is illustrated by a fine series of full-page reproductions from famous sculptures, and some modern pictures, including one from Sir Edward Burne-Jones on the story of Perseus.

*The Temple Reader* (Horace Marshall and Son), edited by E. E. Speight, B.A., appears in a new edition, rearranged, greatly enlarged, and beautifully illustrated. Professor Dowden supplies a suggestive and scholarly introduction. The selections are thoroughly representative of the world's literature, having been made with rare judgment and from a very wide field. Homer, Herodotus, Plato, and other classical authors are represented in readable translations of suitable extracts; and the works of the Hebrew prophets are drawn upon, as well as the great writers who have contributed to the stream of literature, from Dante and Malory to Whitman and Ruskin. Looking to its distinctive excellence, we are disposed to regard *The Temple Reader* as, without exception, the best book of selections suitable for school and home reading.

The same publishers issue, as No. 2 of their *New English Series*, a small book of *Selections from the Poetry of William Wordsworth*, edited by E. E. Speight, B.A., with an appreciative introduction by Dr. Edward Caird, the Master of Balliol. The editor's work has been done with care and judgment, and the typography also deserves praise.

## Reading as an Art.

Early in this notice we referred to the difficulties attending the initial steps in the necessary work of learning to read. It is fitting, before we close, that we should make some reference to what, both on account of the training and qualities it requires, and the lofty and pure pleasure it is capable of affording, may be described as the fine art of reading. Instead, however, of elaborating any plan for acquiring skill in this art, we will call attention to two interesting and useful books bearing on the subject. The first is entitled *Clear Speaking and Good Reading* (Longmans, Green, and Co.), by Arthur Burrell, M.A. It is introduced by a commendatory preface by Mr. P. A. Barnett, H.M.I.S., which contains a very sensible plea for simplicity, self-control, quietness, and clearness in speech and reading, in school and elsewhere; and the author claims for his work that it is "a study in being distinct, quiet, natural, and restrained." The advice contained in the early chapters, on voice training and management, and on pronunciation, is extremely practical and valuable. The system of vocal gymnastics seems, however, too elaborate to be practicable in ordinary schools, though a selection from it might well be made with advantage. The chapters on "Reading and Reciting," and on the "Higher Study of Reading and Speaking," are full of important suggestions. To refer to one point only, the list of suitable pieces for practice in memory work selected from Greek, Latin, French, and German literature, and the Bible, followed by a long list of pieces from English authors, might furnish valuable aid to any teacher in a primary or secondary school. An appendix contains a list of useful authorities, French and German books on reading, works on gymnastics, phonetics, reading and reciting, as well as collections for practice.

*Reading and Readers* (Methuen and Co.), by Clifford Harrison, is of a less technical character. The author is well known as a most able and finished reciter. His aim has been "to present a brief survey of the chief methods of reading, and to give in plain and untechnical language a few hints from practical experience and observation." He strongly insists on the essential difference between reading and recitation, and deprecates all extravagance of emphasis and exaggeration of expression. The three methods of reading which he describes are dramatic reading, rhythmic reading, and reading as applied to public speaking. Of the first kind he distinguishes two grades, according to the degree in which the reader attempts to realise the circumstances and characters of the dramatic scene. Rhythmic reading is defended as especially appropriate for reading poetry or serious prose of an elevated character. Mr. Harrison especially deprecates the multiplicity of rules and directions for giving expression to different emotions. Modes of expression should spring from the reader's intelligence and personal sense of fitness. This little book is interesting from the special qualifications of the author, and will be found very suggestive.

## Helps to Recitation.

We quite accept the dictum that recitation differs essentially from reading, but this point in their relation is worth noticing: while careful training in the art of expressive reading will prepare the way for effective recitation, the practice of recitation is likely to react on reading, and to make it more intelligent. We accordingly welcome whatever is likely to encourage and assist this useful practice. In ancient times, literature was passed on from generation to generation by the lips and tongues of reciters; and now, even in the days of cheap printing, literature will continue to be more truly a living force as long as children are trained to find pleasure in the repetition of passages of poetry and dramatic scenes.

Now that annual individual examinations in public elementary schools are practically done away with, and the teacher has freer scope in arranging his work in various subjects, it might be well to set aside the narrow limitations of passages to be learned by heart in the lower standards, and to have more frequent changes of pieces, instead of wearing the lines threadbare by keeping the same selection for a year. Our literature affords abundance of choice, and we will employ the remaining space at our disposal in calling attention to several selections of pieces for recitation which have just appeared.

*Macmillan's Recitation Books: New Series*, consists of twenty-four booklets, containing poems from the works of Tennyson, Matthew Arnold, George MacDonald, Christina Rossetti, Jean Ingelow, and other well-known authors. They are carefully grouped to suit different standards, with brief, helpful notes, and are capitally printed.

In nine *Recitation Books for Schools*, Kegan Paul, Trench, Trubner, and Co. publish an entirely fresh selection from the poems of Sir Lewis Morris. They may be safely recommended to teachers in search of unhackneyed pieces; and for their suitable length, and for their style and character, which come within the range of intelligent children, they are likely to become favourites.

*The Caledonia Recitation Book* is a series of eight cheap booklets ranging from the first for junior infants to the last for Standards VI. and VII. They have been judiciously compiled by J. W. Paterson, an Edinburgh schoolmaster, who also publishes them. The books for infants begin with pleasant, simple little rhymes, followed by some of R. L. Stevenson's and George MacDonald's verses for children. The later numbers consist more largely of standard pieces, but we find one long poem of Rudyard Kipling's, besides other copyright pieces.

Surely here the teacher has choice enough; and as we bring our string of comments to a close, we hope every reader may find amongst them some useful aid or encouragement in his task of spreading the love of literature.

At the moment of going to press we have received from Messrs. J. M. Dent four charming little books called *The Walter Crane Readers*, by Nellie Dale, and a larger introductory book for teachers, *On the Teaching of English Reading*, by the same author. The series is stamped with so much of interest and novelty that we propose to describe it more fully in a later number.

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J. N. Masters, Esq., Hope House, Rye, Sussex.

DEAR SIR,—I have much pleasure in testifying that during the three years you have advertised in our Journal (whilst under my management) I have not received one single complaint from any of my comrades or readers as to the quality of the goods supplied to them, or that your system of payment has in any way pressed hardly upon them. From personal experience I can testify to the quality and workmanship of your watches and jewellery, as you will remember I had occasion to order some goods personally for friends nearly two years ago, and they have given the utmost satisfaction. I may mention that whilst visiting a comrade who lives nearly 500 miles distant from Rye, I was surprised to learn that he had bought a perambulator from you, and that he was as well satisfied with it as if it had been bought in Glasgow or Edinburgh. It is evident that, no matter the distance your customers may be situated from Rye, you make a special point of supplying them with the genuine article. Trusting your business may continue to prosper in the future as in the past,

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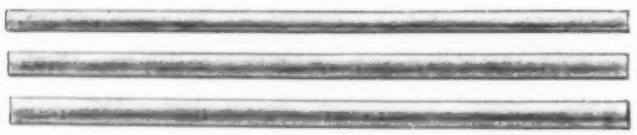

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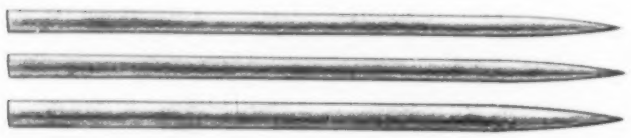

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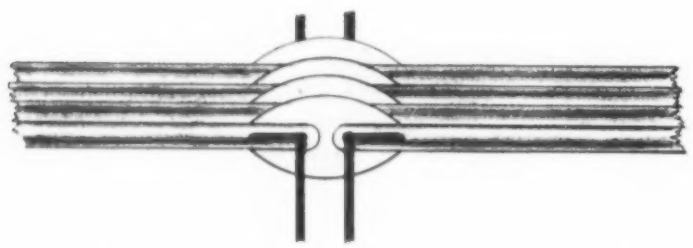

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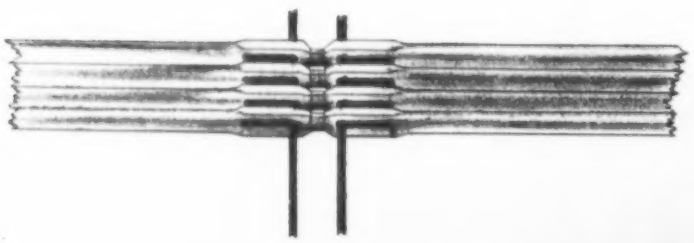

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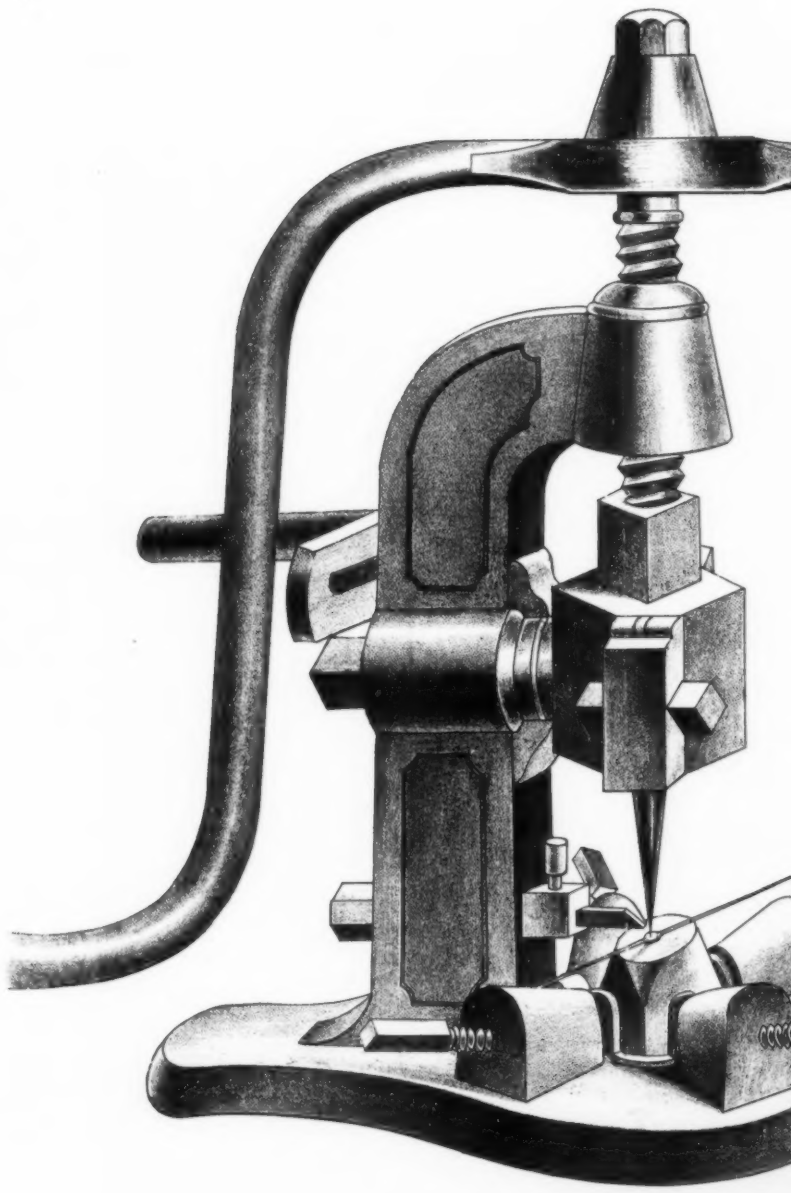

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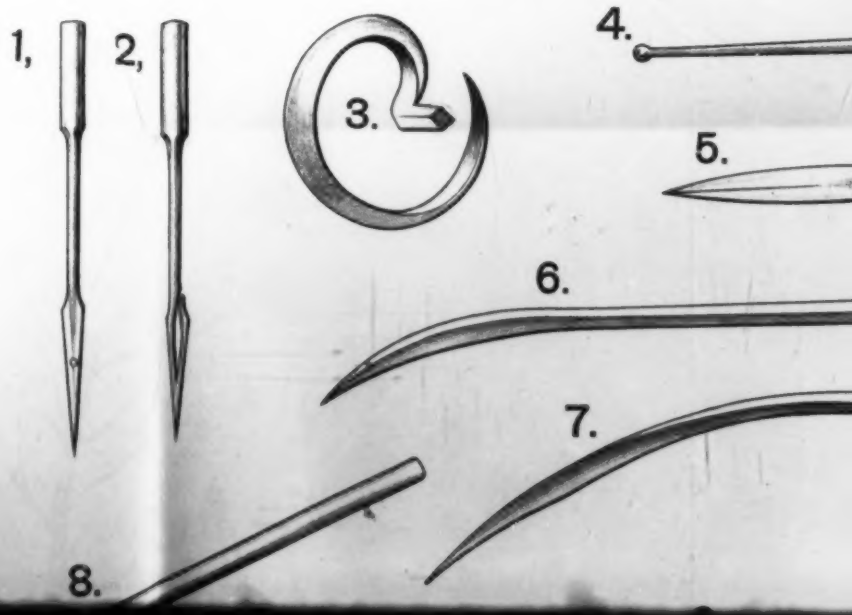

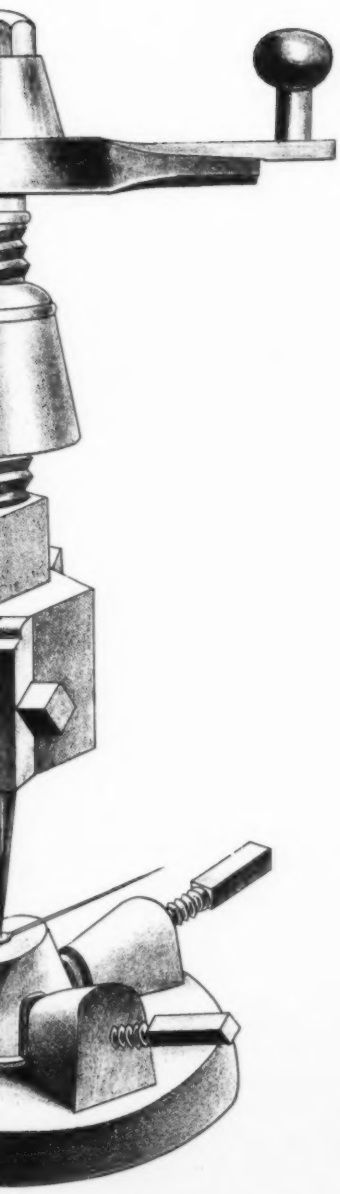

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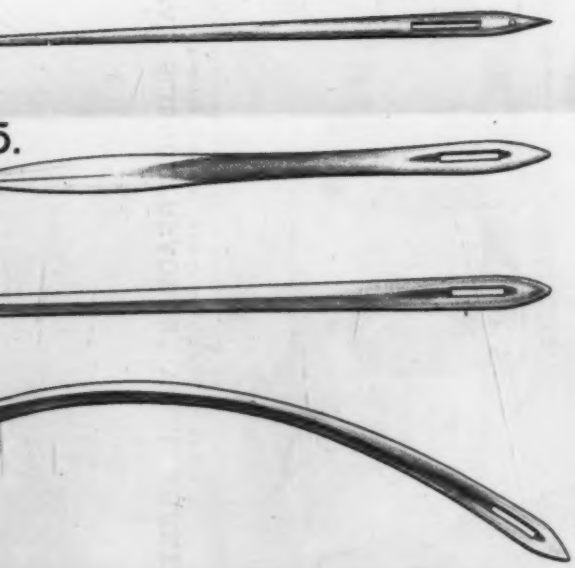

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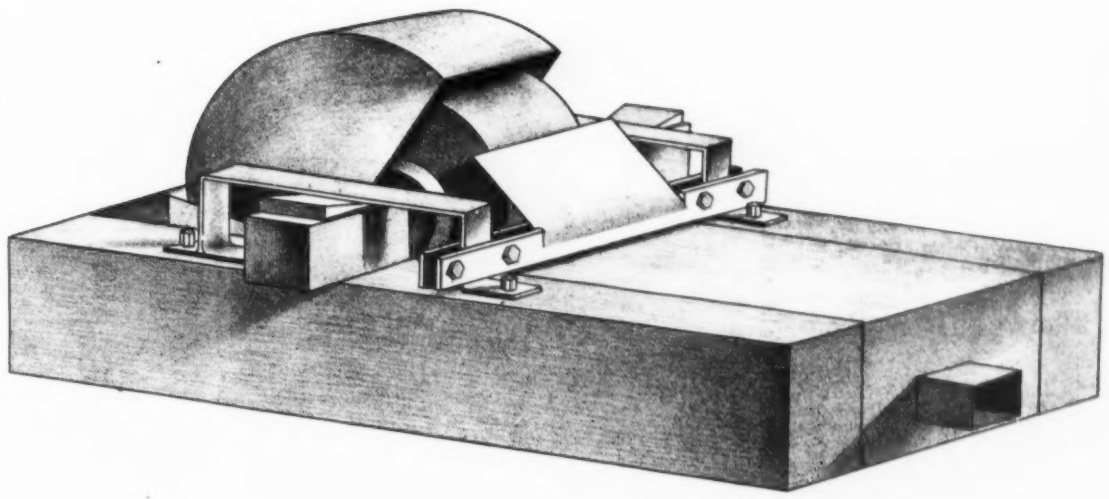

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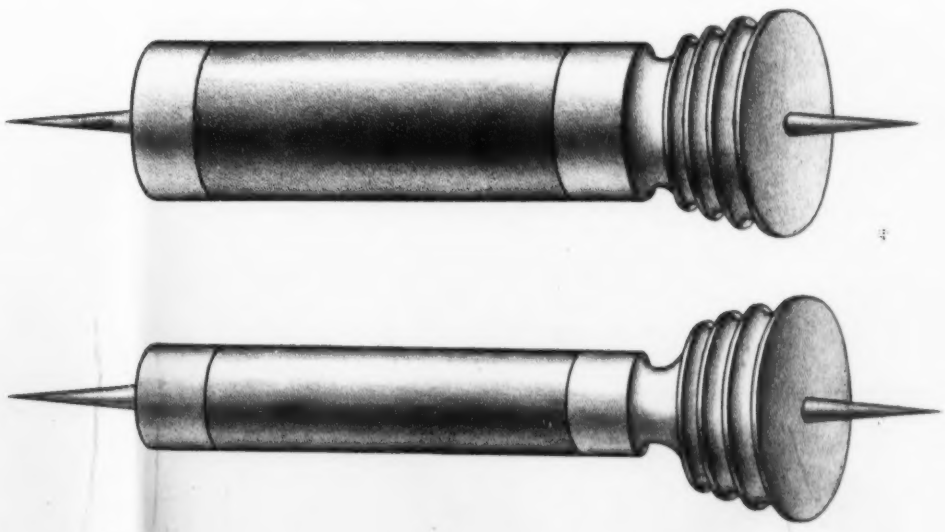

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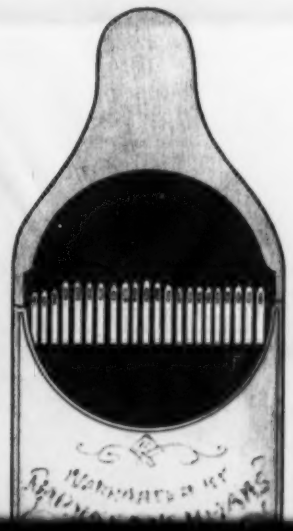

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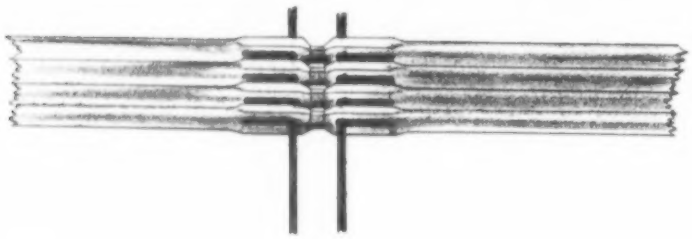

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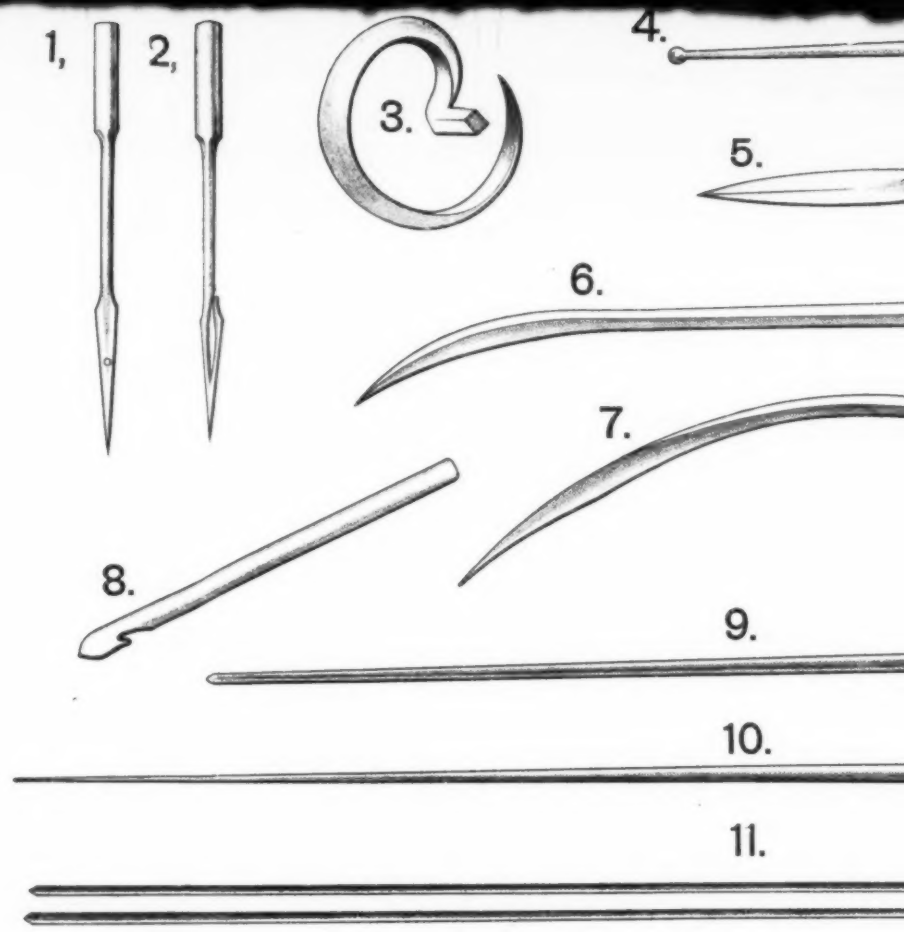


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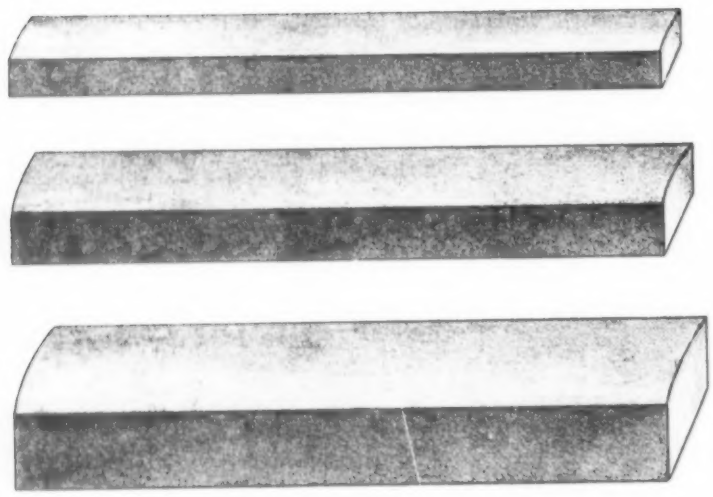

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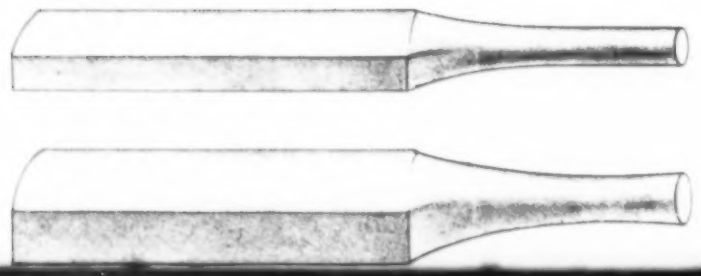

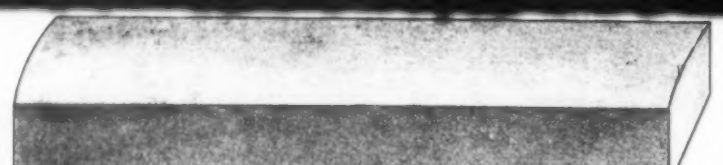

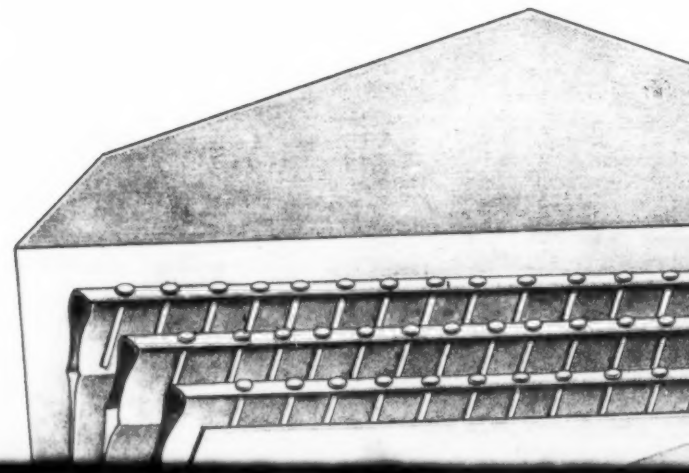

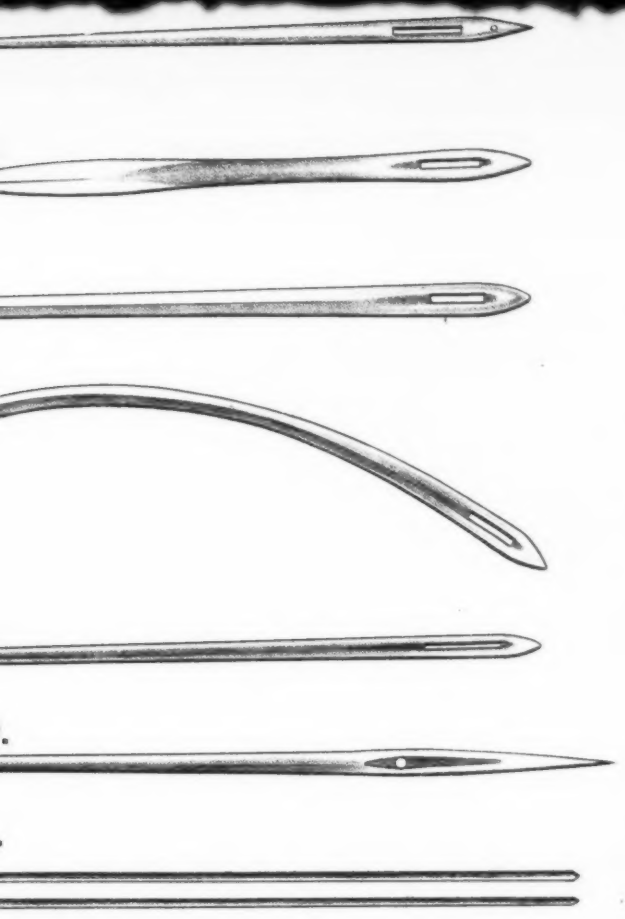

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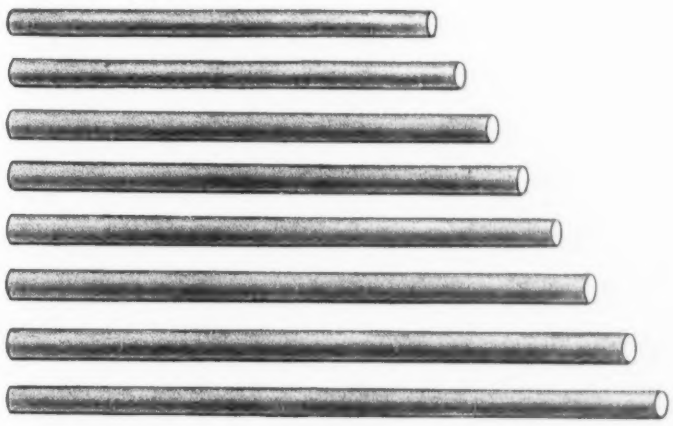

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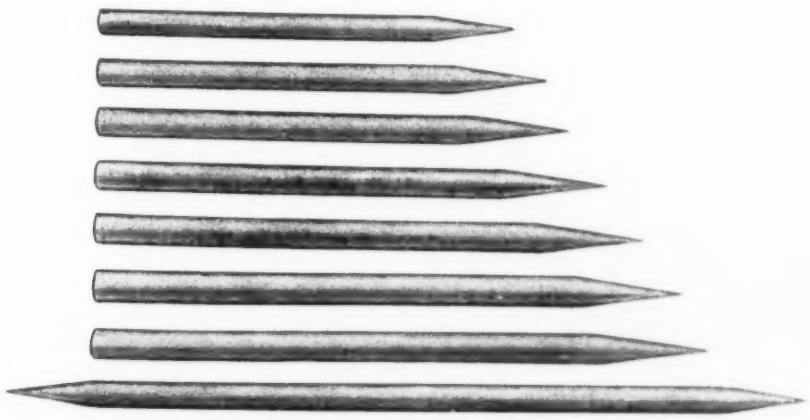

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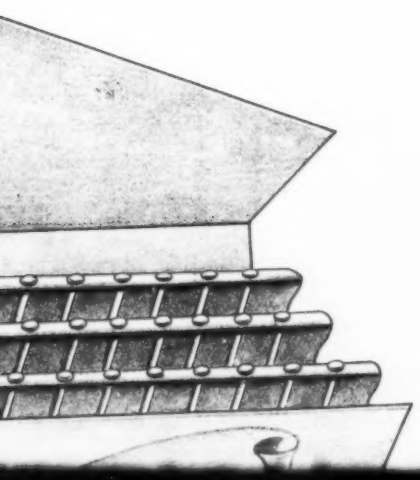

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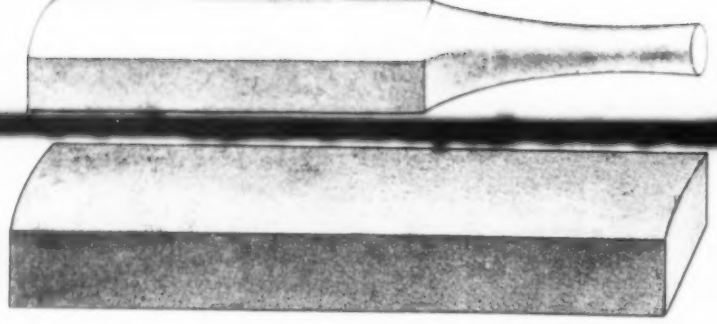

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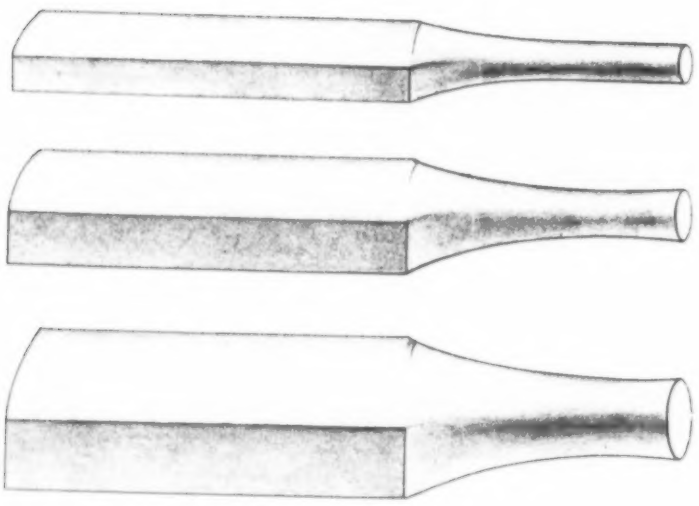
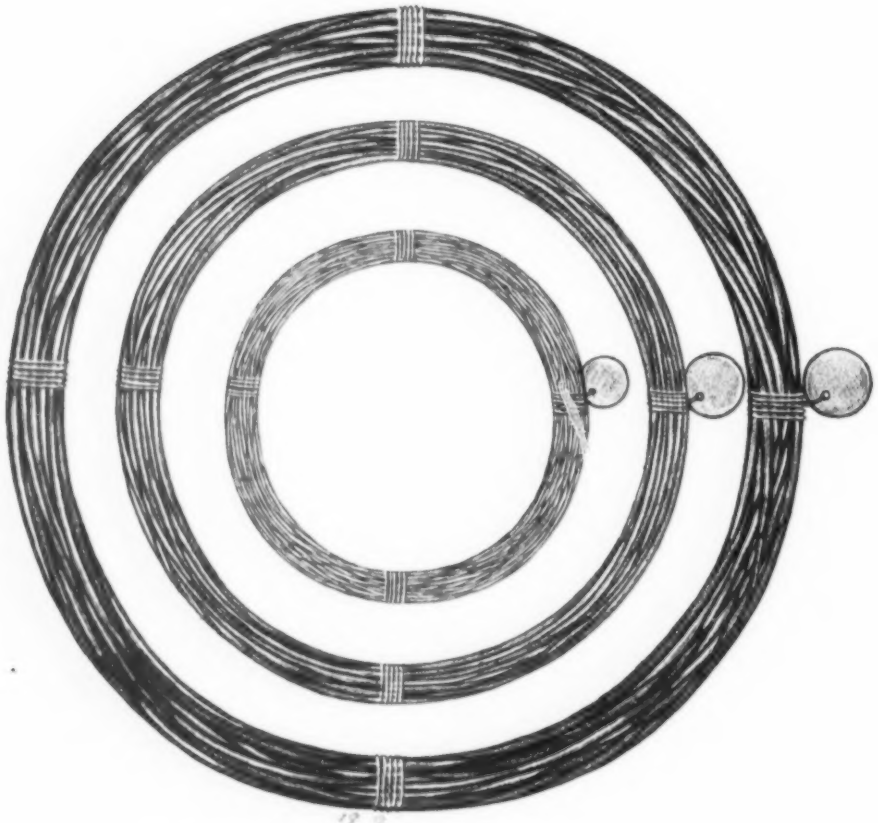
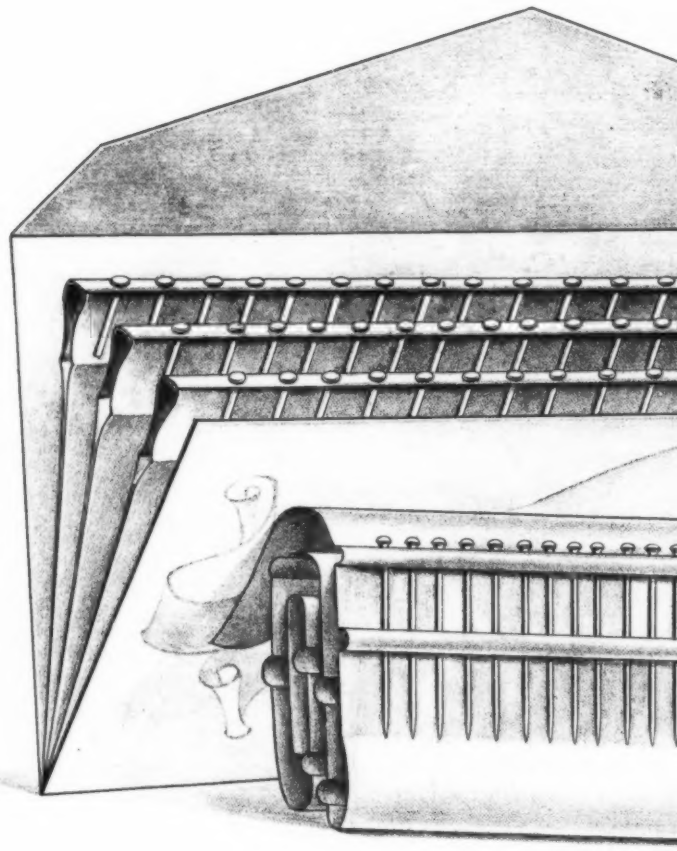


Strips for Drawing Wire (x 3).



Drawn Wire, in coils.



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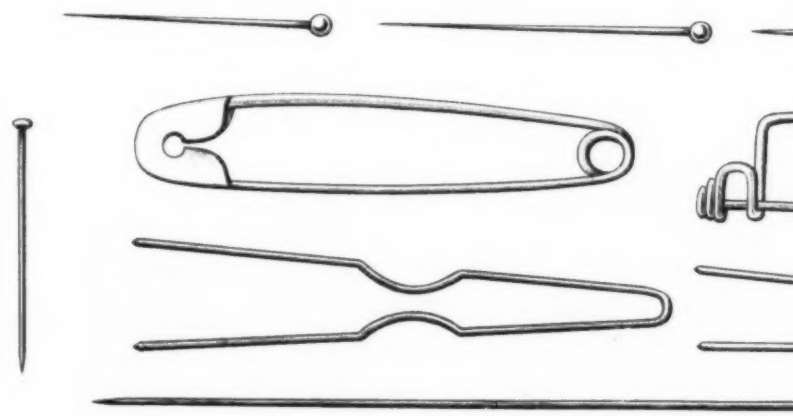

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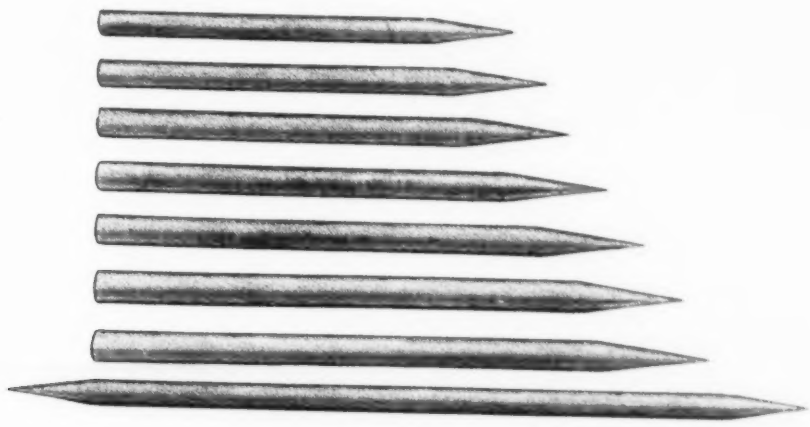

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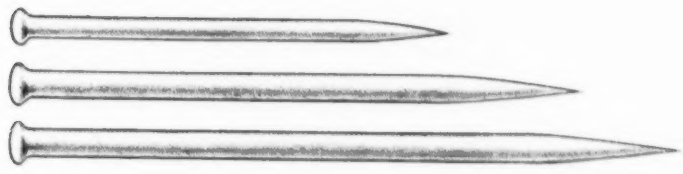

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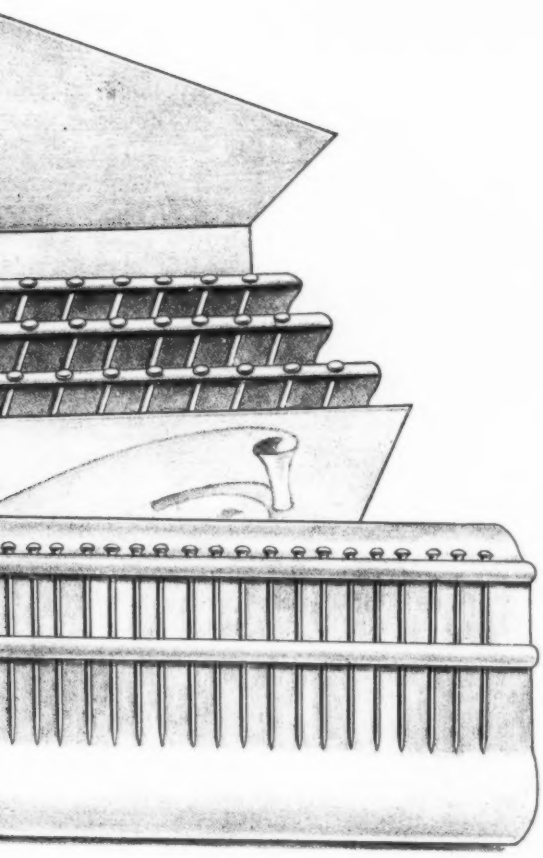

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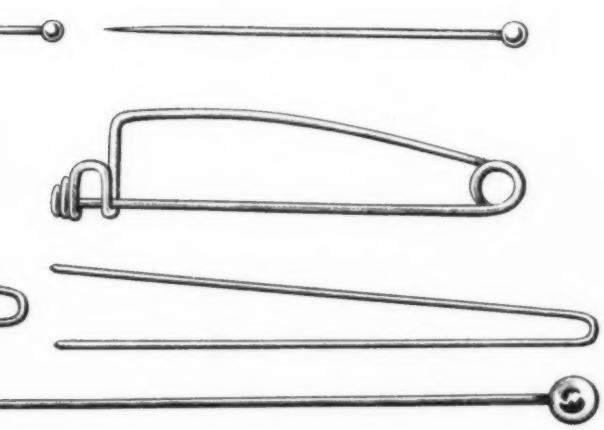

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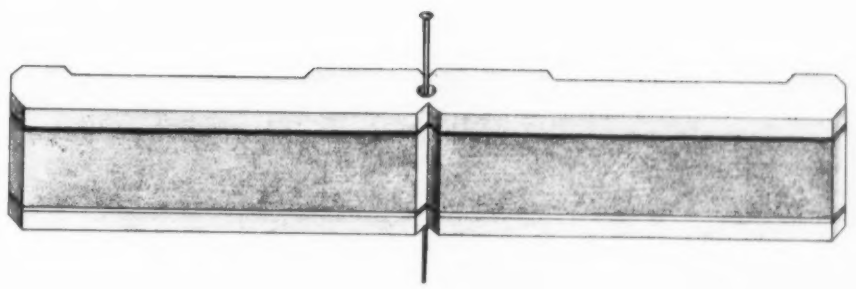

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